Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

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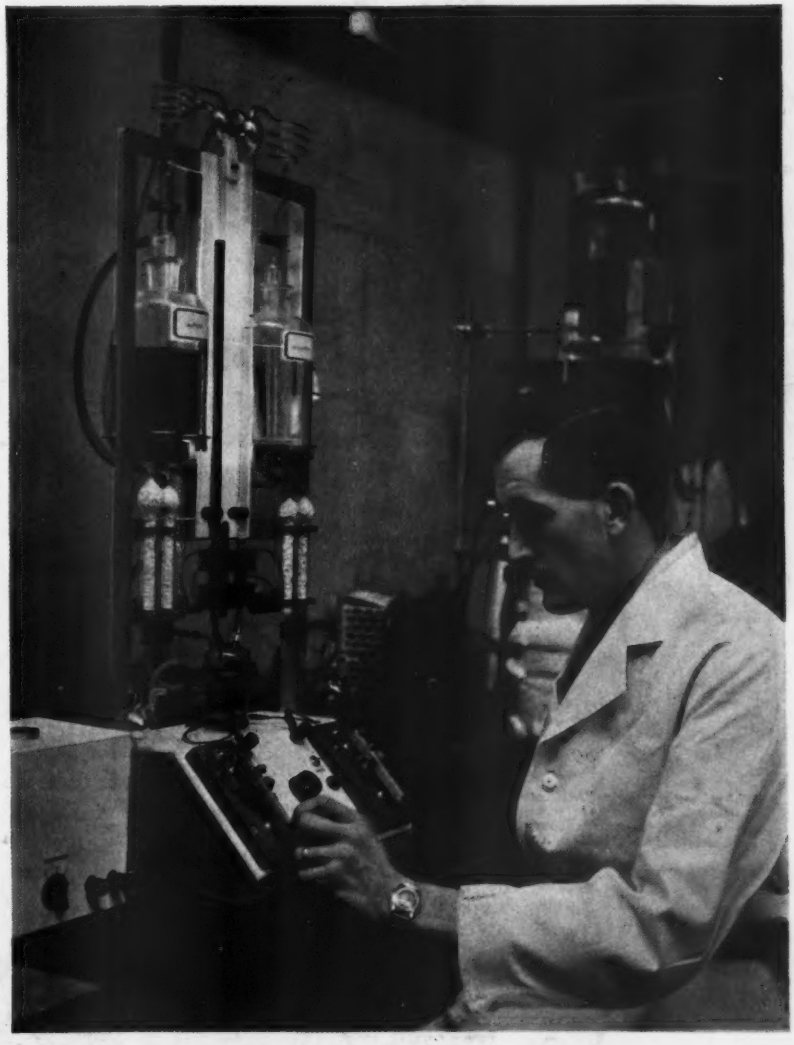
DETROIT

BACKGROUND TO I.C.I. PLASTICS

Keeping Watch

Raw materials of the highest quality are used in the manufacture of I.C.I. plastics, and this excellence is maintained by constant routine checking. Here a Plastics Division chemist is determining the moisture content of a plasticiser. Such constant vigilance is one of the many factors that guarantee the uniform excellence of I.C.I. plastics.



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With acknowledgments to The Vacuum Oil Company Ltd., and to the manufacturers of the pack, Messrs. John Tye & Sons Ltd., 457 Caledonian Road, London, N.7.

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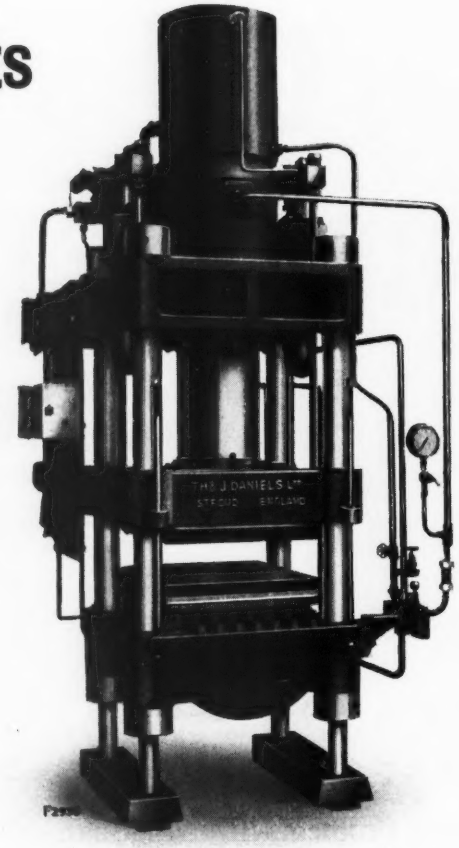

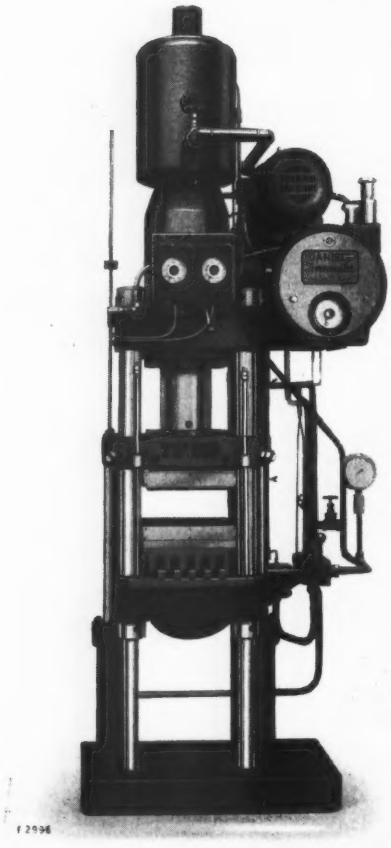

(Above) Daniels 150-ton Downstroke Press with self-contained pump unit, piston valve and electric platens.

Main ram stroke	18"
Platen size	26" × 26"
Daylight between platens (with stool)	24"
Pump motor	5 h.p.

* (Left) Daniels 50/75-ton Downstroke Press with self-contained pump unit, piston valve, electric platens, Daniels Process Timer and slowing device which retards the final closing speed of the press to avoid damage to the mould.

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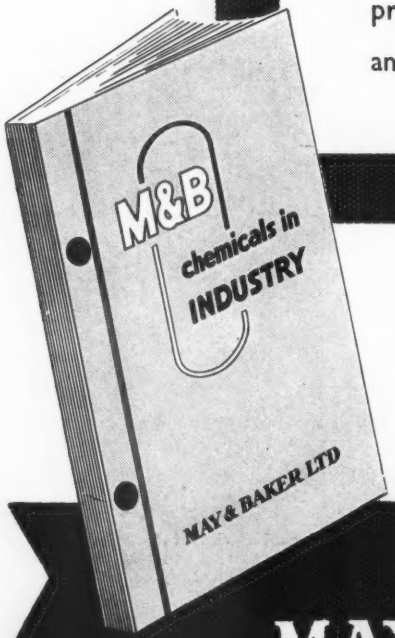

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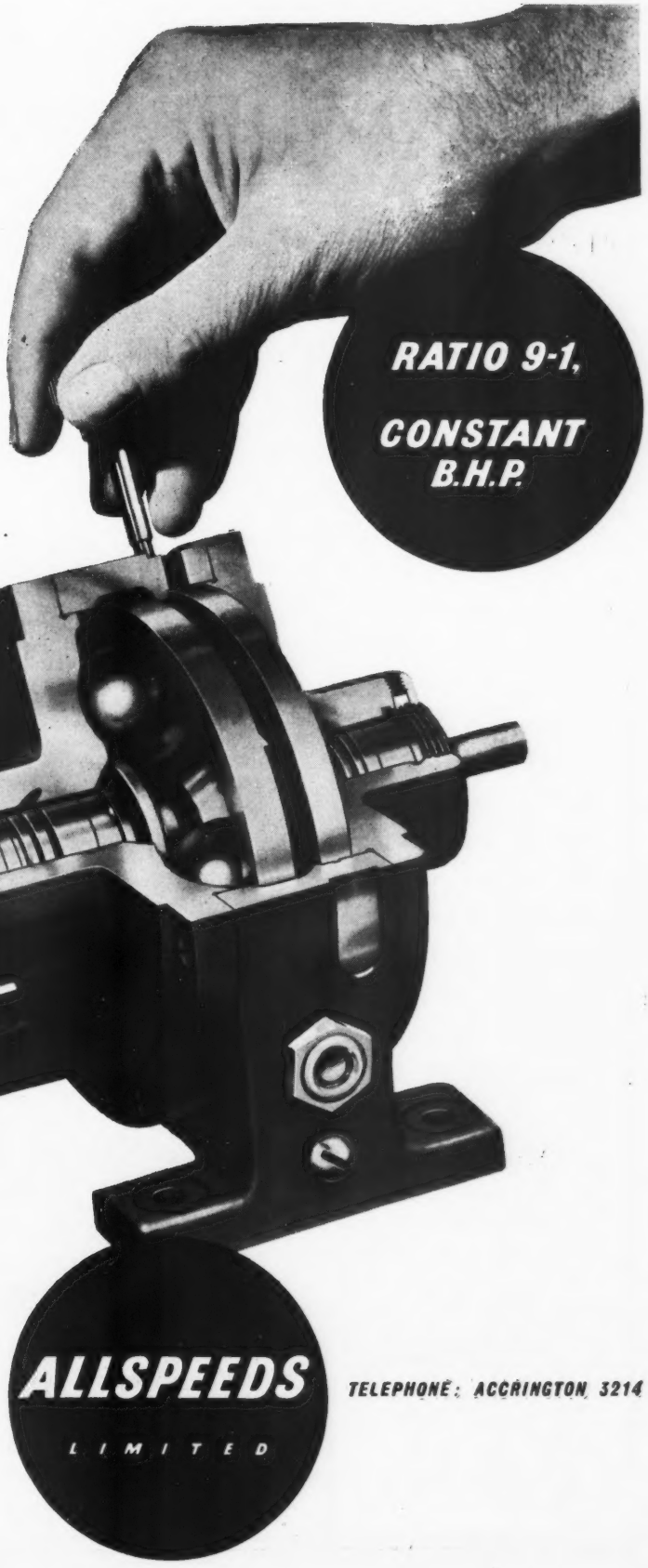

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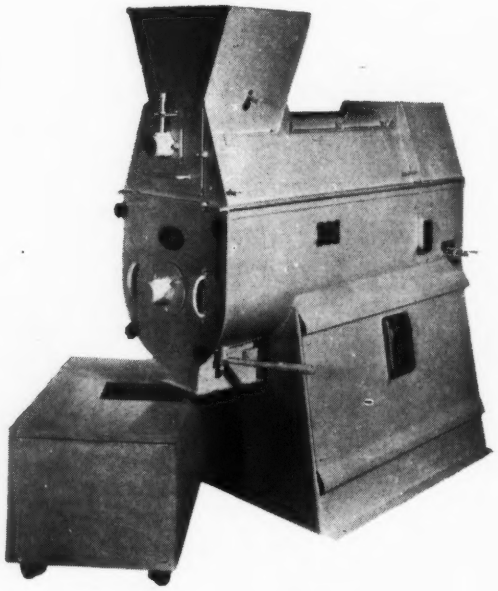

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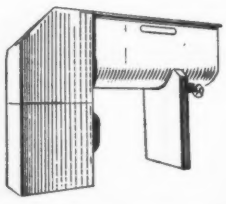

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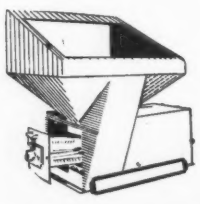
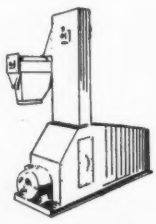


FEEDER/ELEVATOR/SIFTERS



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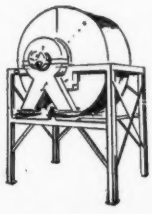

Hearing Aid Case in

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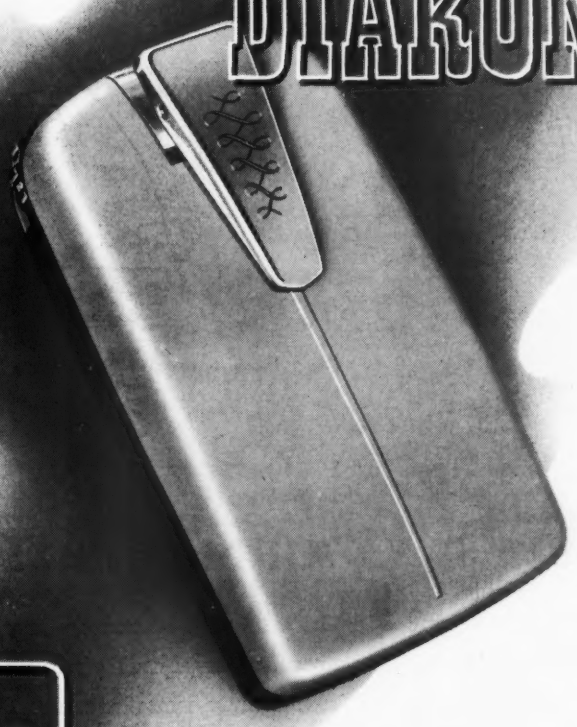

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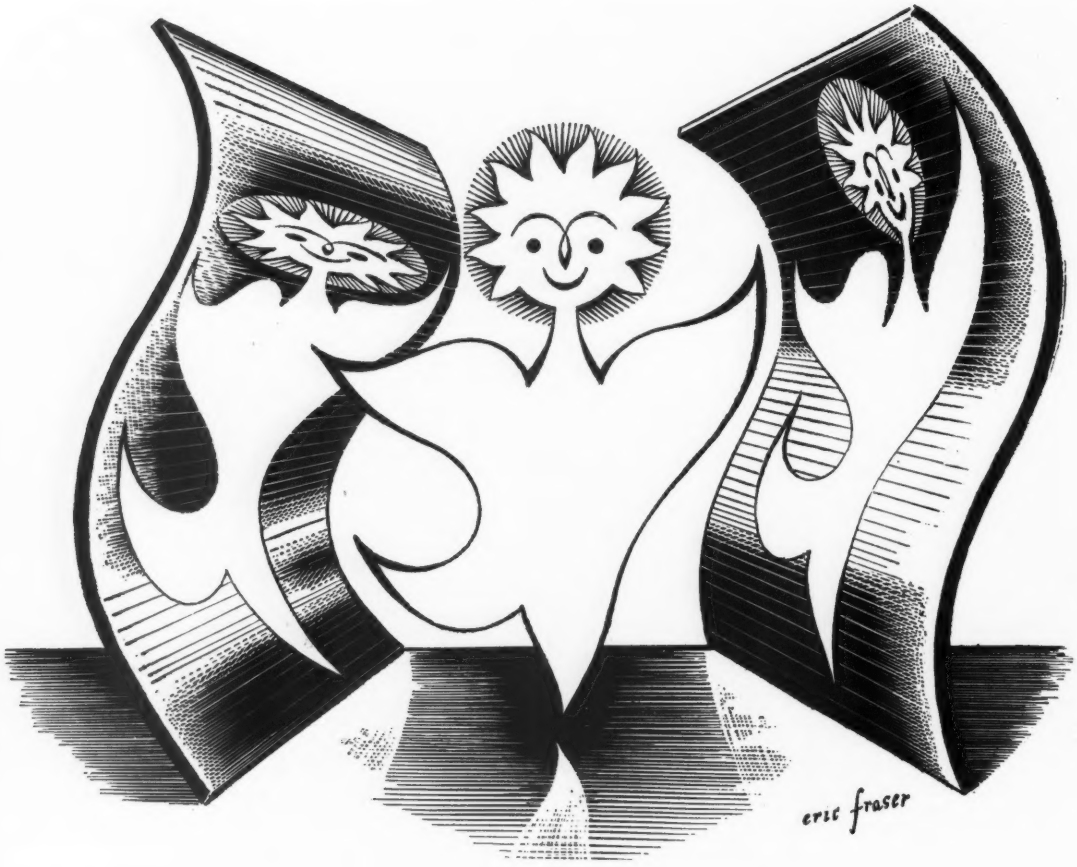

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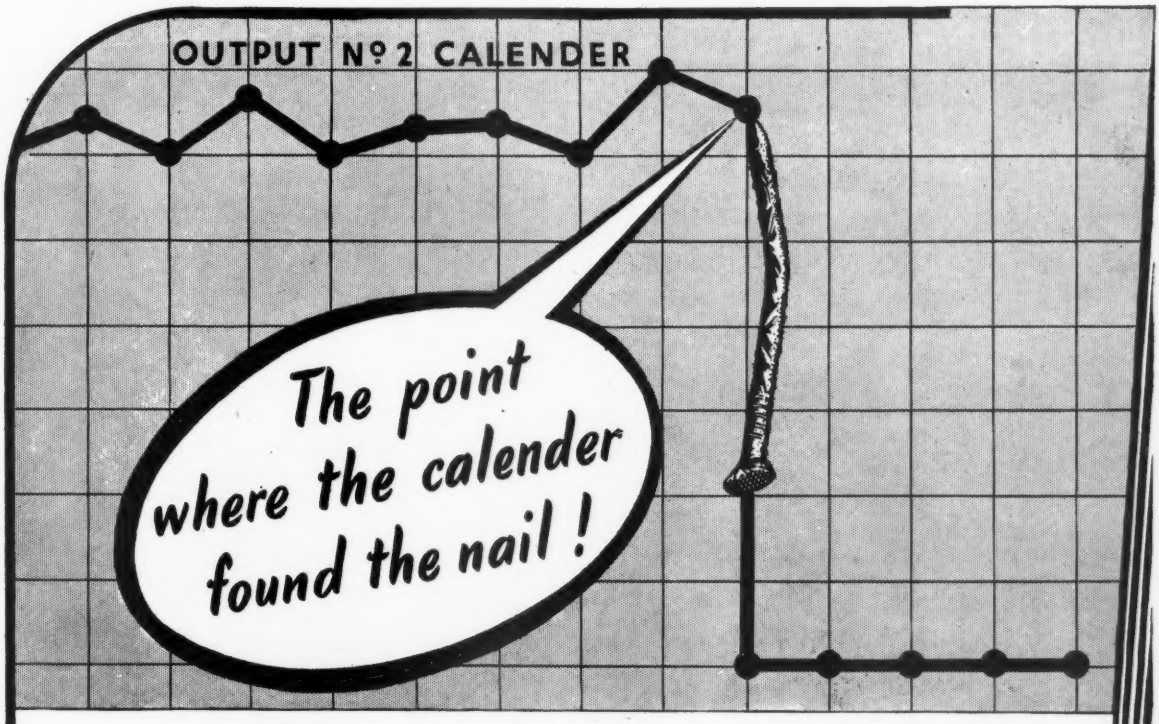

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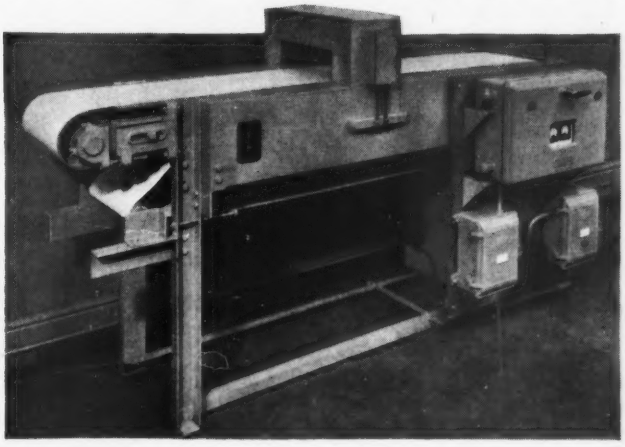

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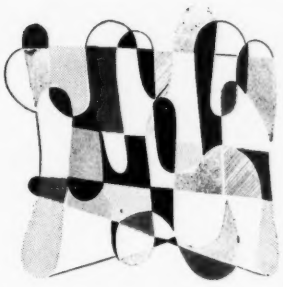

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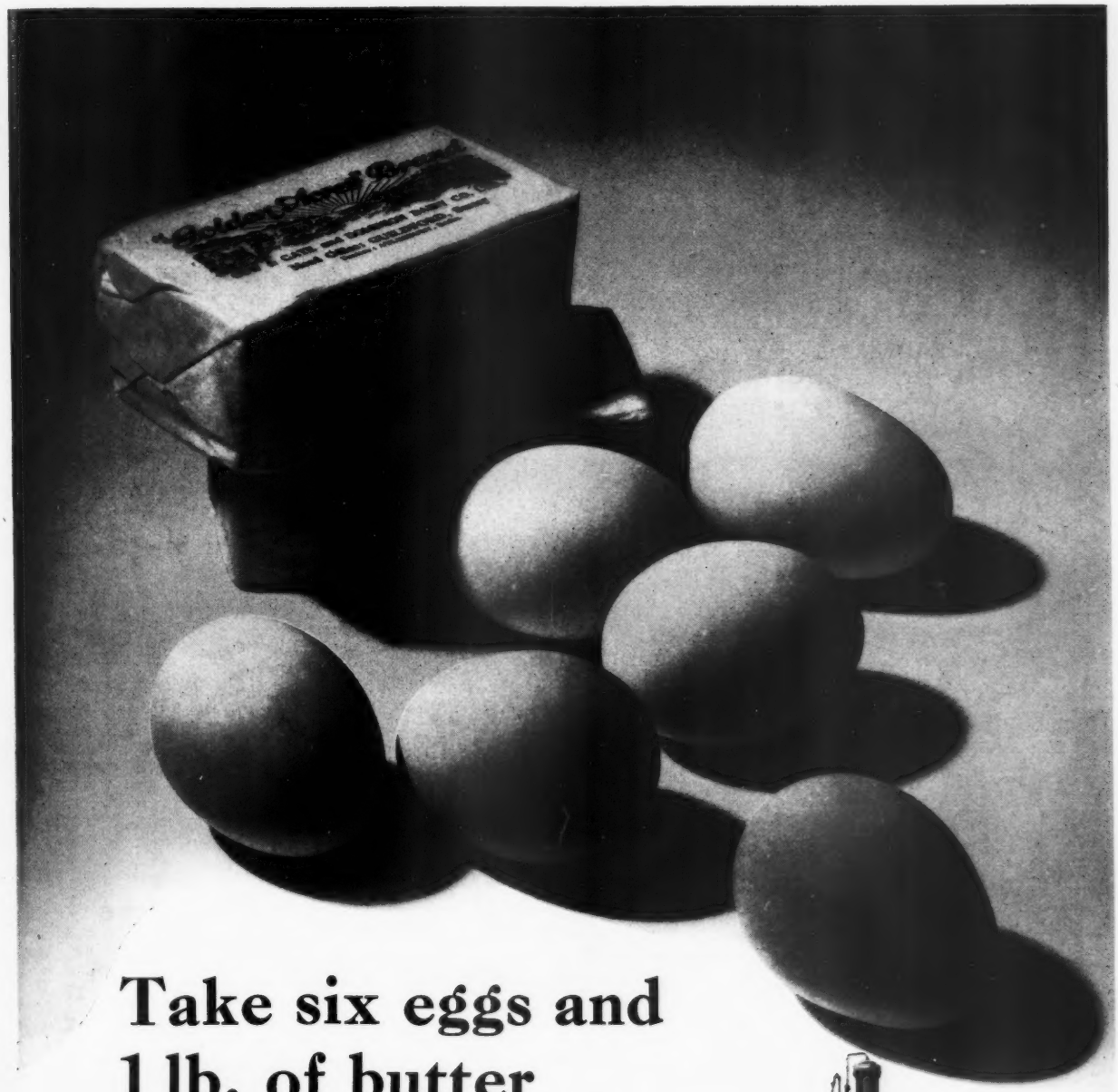

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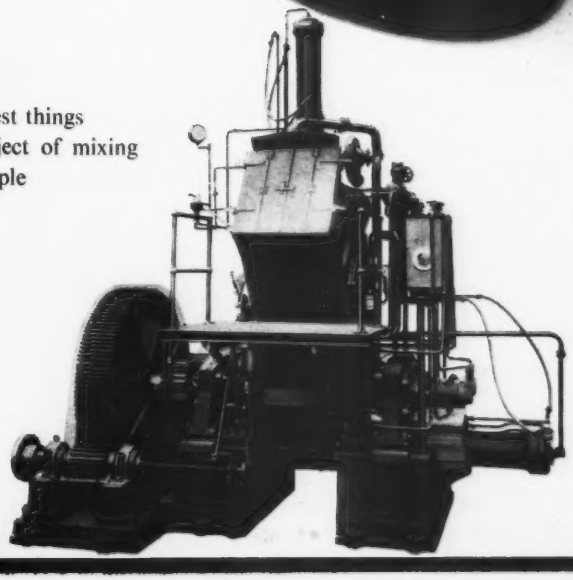

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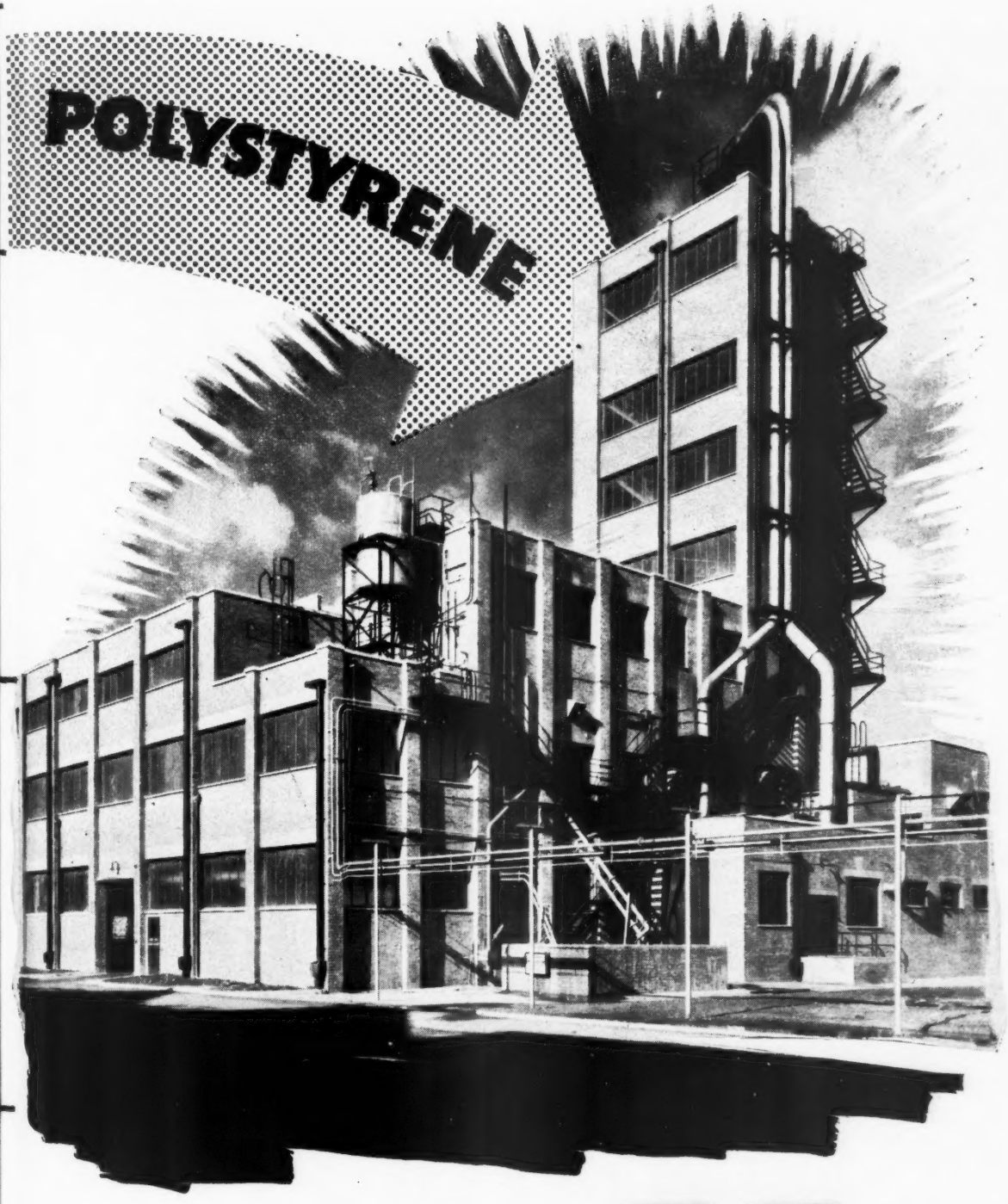

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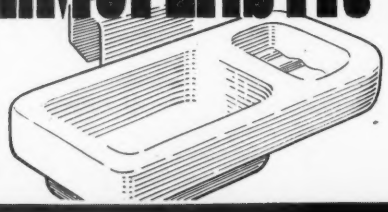
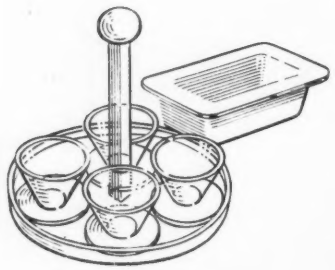
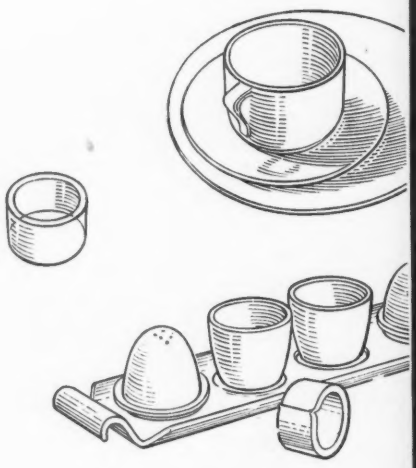
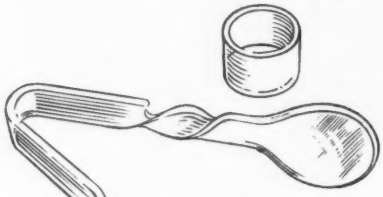
SOFTENING THERMOPLASTIC SHEET









BY

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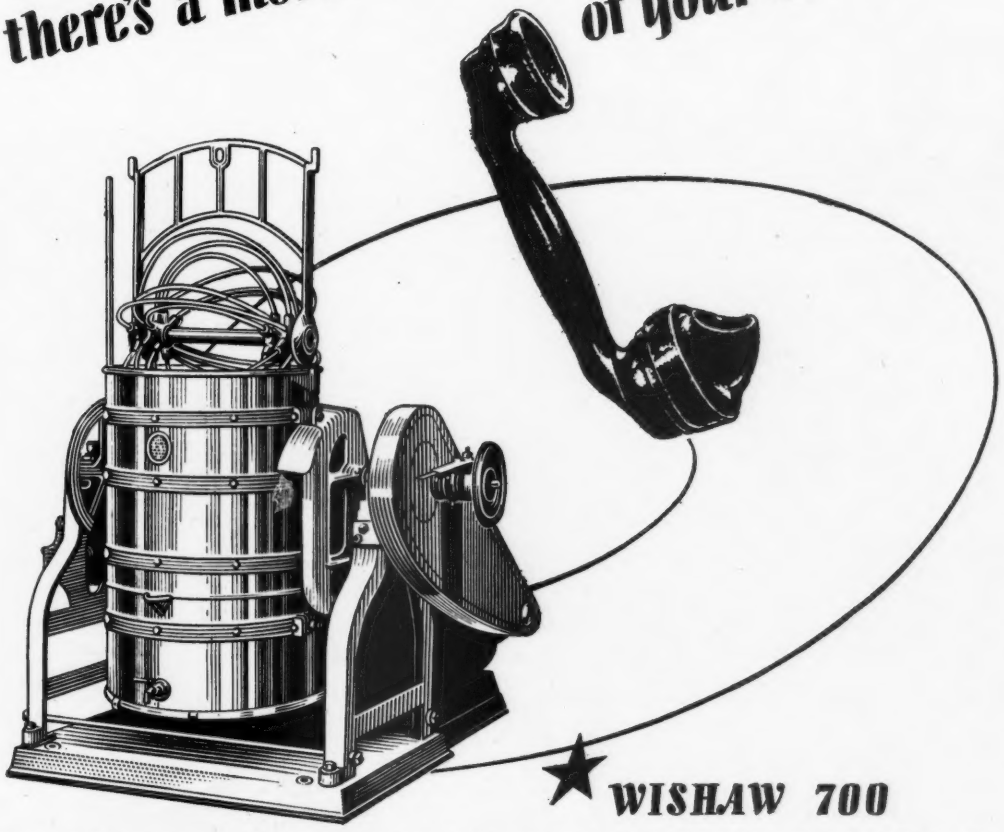

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Morton
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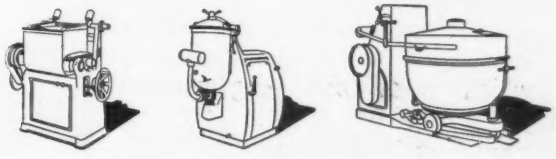
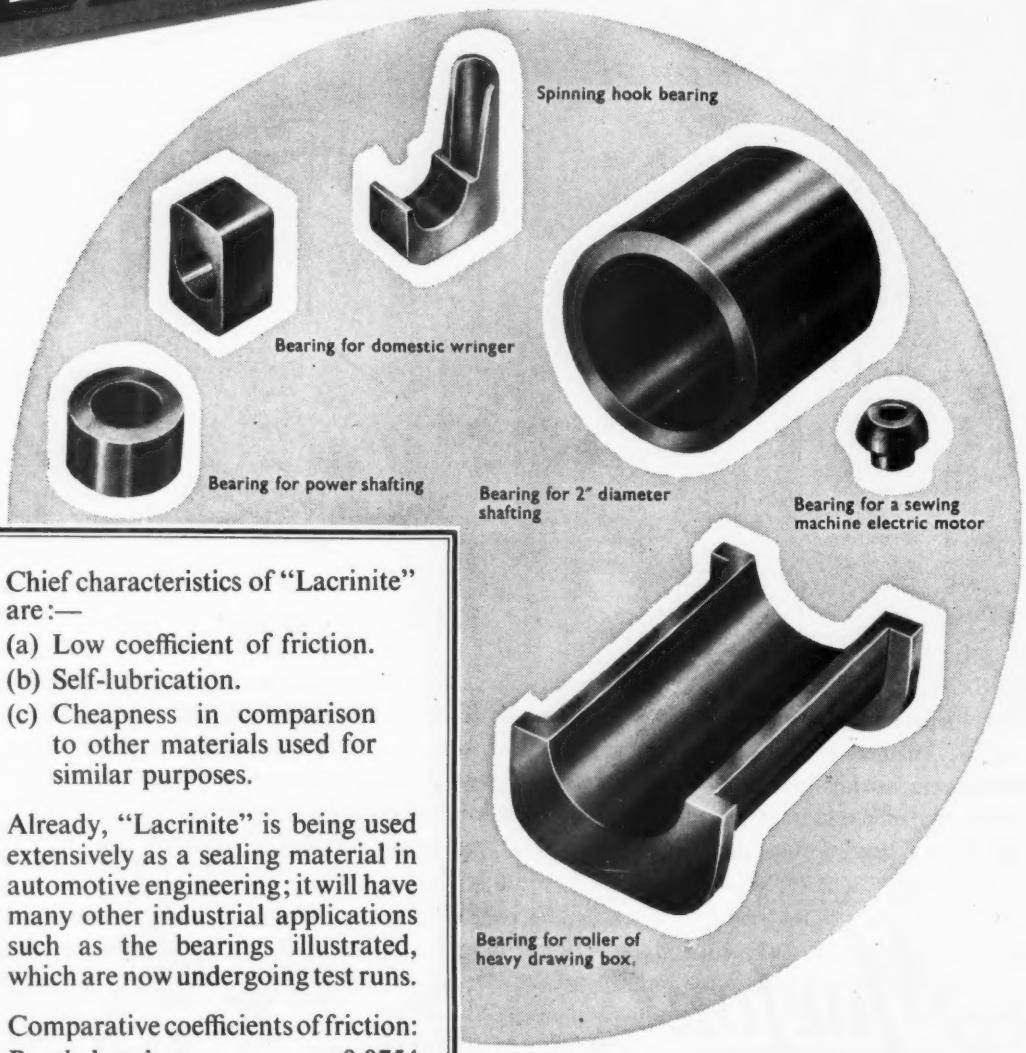


Mixing is our business

A new material for seals and bearings

LACRINITE

TRADE MARK


Spinning hook bearing
Bearing for domestic wringer
Bearing for power shafting
Bearing for 2" diameter shafting
Bearing for a sewing machine electric motor
Bearing for roller of heavy drawing box.

Chief characteristics of "Lacrinite" are:—

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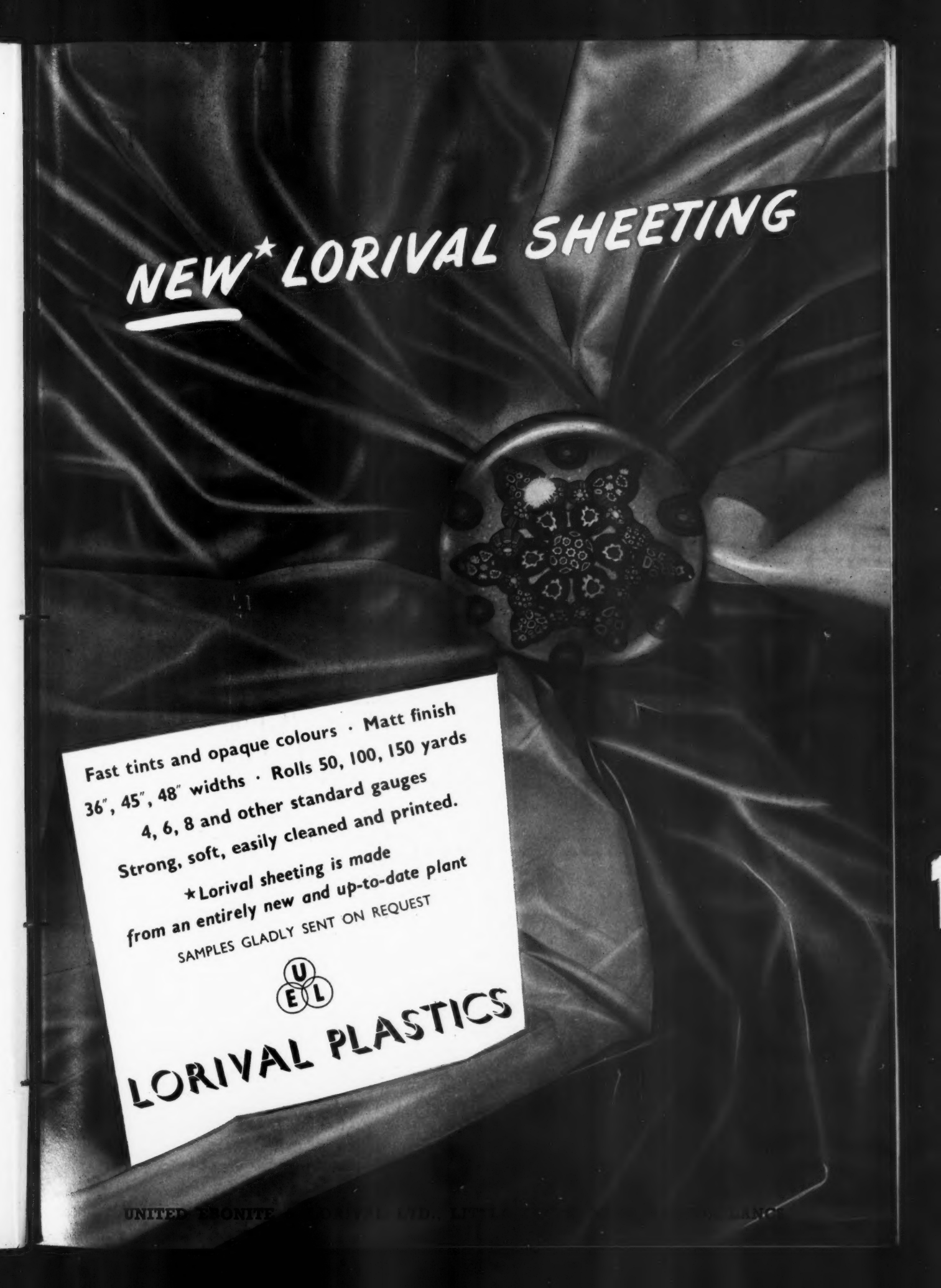
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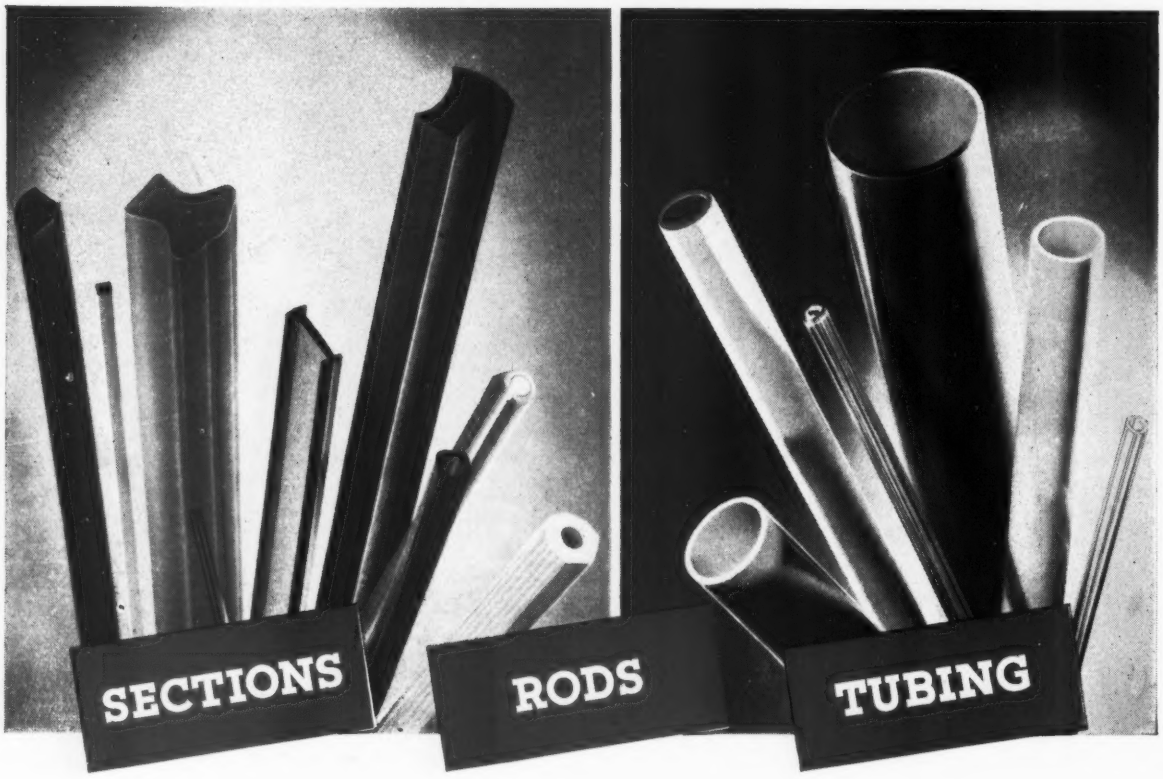

'Cellastine'
TRADE MARK

EXTRUSIONS

CAN BE USED IN MANY WAYS...

You can see from the illustrations that 'Cellastine' Extrusions take many shapes and forms, as tubes, rods or sections. Some of these examples have been produced experimentally; some to special order. If they give *you* the idea of using one of them—or something like it—in your particular business, why not have a talk with our Technical Staff? It may well be that their experience and advice could turn your idea into practical use. 'Cellastine' Extrusions will not chip or crack; have touch-comfort and colour-appeal; are washable and will polish to a permanent high gloss; and are easily machined and fabricated.

'Cellastine' Extrusions are thermoplastic and solely manufactured by

BRITISH CELANESE LIMITED

PLASTICS DIVISION, CELANESE HOUSE, HANOVER SQUARE, LONDON, W.1.

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FORMICA REGD.

chosen for the "Elizabethan"

For the new "Elizabethan" class Airspeed Ambassador aircraft shortly to be operated by B.E.A. on European routes, the table tops are surfaced in pink linette FORMICA. This extremely practical laminated plastic considerably enhances the bright, friendly atmosphere of the new aircraft's decorative scheme.

Photo reproduced by courtesy of Airspeed Ltd.

FORMICA is

HARD-WEARING — It resists alcohol, acids, alkalies, spilt foods and constant rubbing. Articles can be dropped on Formica — yet the surface will not crack or craze. Kicking and scuffing cannot mar it.

HYGIENIC — Its hard, smooth surface is completely non-porous and cannot harbour germs.

LIGHT IN WEIGHT — Formica is only half the weight of aluminium.

HEAT RESISTING — Temperatures up to 120° C. cannot affect Formica — and, with the Cigarette-Proof grade, table tops cannot be damaged by burning cigarette ends. Formica will not support combustion.

PERMANENT — Once installed, Formica never needs renovation nor renewal. A wipe with a damp cloth keeps it bright and clean. Colours and designs are fadeproof — cannot wear away.

For full information about FORMICA, please write to:—

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'FORMICA' is a registered trade mark and De La Rue are the sole registered users.

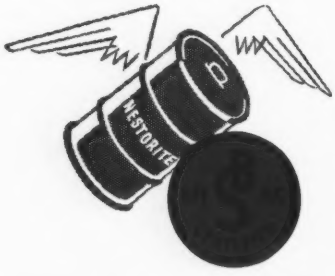
And now, Gentlemen, we propose to take a leap back in TIME to centuries preceding Fergus O'Nestor.

Unfortunately, we have no records of the earliest family tree from which our Ancestors swung by their tails, but our priceless archives record that a primitive type of Genus Homo known as Ferg lived in a cave shared by his wife and had two brats known as Ferg'Sons—plus a pet pterodactyl and ponderous brontosaurus.

Being a Caveman, Ferg believed in a colourful existence; from various herbs he made a variety of primitive colours and painted pictures on the cave's walls. One day, Ferg'Sons took some of Ferg's colour—mixed it with clay and made the first coloured moulding (reproduced here by permission of the Society of Plastic Antiquities).

It was a revolutionary discovery; henceforth Cavemen need not laboriously cut, chisel and hack to form their rude domestic utensils. Ferg'Sons had evolved a simpler and better way. Thus was the Plastics Industry born.

As descendants of Ferg'Sons, we often drink a silent toast to those Ancestors of ours. Unlike them we do NOT make mouldings but supply the perfected materials from which our customers "form" their own "conclusions."



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HOME AND OVERSEAS ENQUIRIES TO: SPECIAL CHEMICALS DIVISION, CRESCENT HOUSE, NEWCASTLE-UPON-TYNE, ENGLAND

ask your moulder . . .

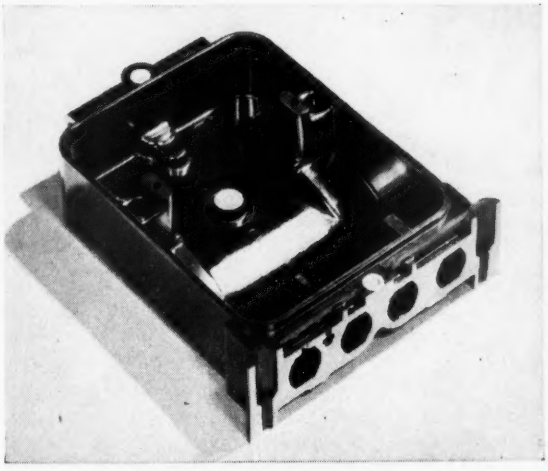
This is the fourth in a series of announcements designed to assist Buyers in purchasing plastics moulded articles or components.

Buyers must sometimes be alarmed by the tendency shown by many moulders to alter specified designs. In their efforts to cut prices, to simplify tools and moulding procedures, moulders have been known to make such changes that the resultant mouldings, though no doubt serviceable, were different from what was originally visualised.

You will have your own very good reasons for laying out a design in a certain way, even though it incorporates unorthodox or inconvenient features. You must be guided, of course, by your moulder's advice as to what can or cannot be moulded but his technical skill should be sufficient to enable him to meet your precise requirements.

When you are negotiating with a moulder, therefore, be very careful to ascertain whether his policy is to mould what *you* want, or to alter your designs to suit his convenience. If a moulder is to prove worthy of your job he should be prepared to exercise his ingenuity to produce it — and to produce it economically — to your specifications.

This does not mean that you should never accept alterations. A good moulder can very often suggest modifications which, without altering the functional purpose of the moulding or detracting from its appearance, can effect a substantial saving of time and money. This point is illustrated in the example given here.



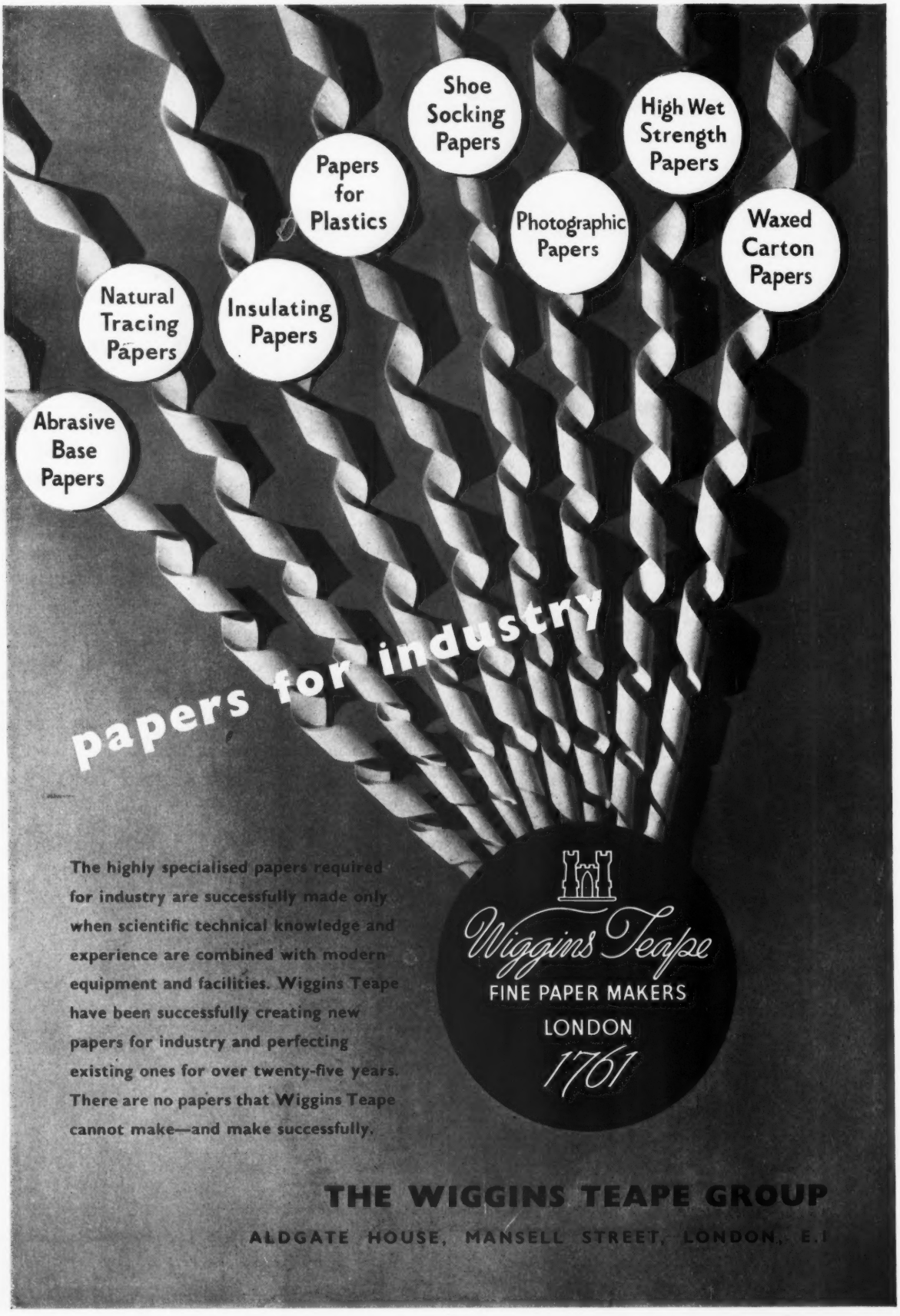
The problem in this moulding (shown sectioned) was the long undercuts. The design was originally laid out so that the cable fixing and shunt insert holes could be cored from the outside. The resulting holes in the end wall were to be filled afterwards by separate mouldings, glued into position. The moulder tackled the job on the basis of withdrawing the cores inwards. This eliminated the need for separate mouldings and their gluing, with a consequent saving in cost; and improved appearance by ensuring that no joint faces would appear on the outside surfaces. Mouldings by The Streetly Manufacturing Co. Ltd. for Ferranti Ltd.

If in doubt, ask **STREETLY**

The Streetly Manufacturing Co. Ltd. makes mouldings in thermosetting and thermoplastic materials and specialises in long runs of the highest quality mouldings. A high percentage of its regular output is of mouldings for manufacturers of electrical equipment and accessories. If you have a moulding job in view, call in Streetly for practical, down-to-earth advice.

B·I·P GROUP

THE STREETLY MANUFACTURING CO. LTD.,
STREETLY, SUTTON COLDFIELD, Nr. BIRMINGHAM. *TELEPHONE: STREETLY 78411.* *TELEGRAMS: BANG STREETLY*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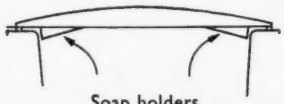
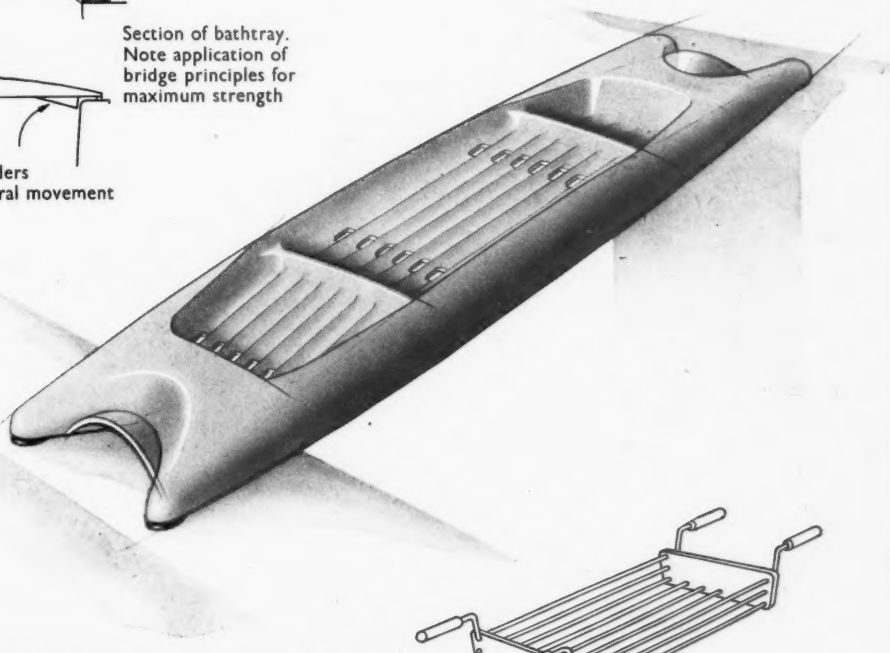
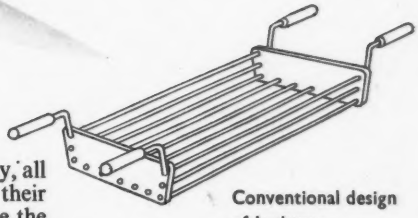
Designer's Diary N.º 4

In this series the B.I.P. Product Design Unit seeks to illustrate how technical requirements can be met to produce pleasing, readily mouldable articles in plastics. Reprints of these announcements will be gladly supplied on request.







Conventional design of bathtray

The Product. Of the few attempts to mould a bathtray, all have so far followed the general characteristics of their wooden and metal predecessors. Two basic faults are the tendencies of such trays to slide about and fall into the bath; and their seat-like structure which, whilst inviting such use, does not make for great strength when reproduced in plastics. This new conception of a bathtray primarily aims to overcome these faults.

The Design. In contrast to traditional design, note first the strong *bridge-like* structure of this bathtray. For additional strength vertical divisions are incorporated between compartments and on what would otherwise be flat surfaces are moulded internal ribs and drain-channels. To locate and anchor the tray, two novel features are incorporated. The deep soap compartments (see diagram) provide a location to prevent undue lateral movement, whilst four small rubber suction pads on the underside prevent the bathtray slipping. An unobtrusive lifting handle at each end provides a fingerhold for lifting against suction.

This bathtray represents a simple compression job for straightforward up-and-down moulding.

The Material. Beetle urea moulding powder is recommended because it provides a wide colour range complementary to contemporary bathroom colour schemes. Although there will be some expansion and contraction due to changes of temperature and humidity, dimensional considerations are not critical in this application. Urea material is, therefore, the most economical to use for the job.

The B.I.P. Technical Advisory Service is always ready to help moulders in any problem which may arise regarding product design, mould design, materials and moulding techniques. This consultative service is freely offered, without obligation, and applies to moulding in thermoplastic as well as thermosetting materials.

BRITISH INDUSTRIAL PLASTICS LIMITED, B·I·P GROUP **1 ARGYLL ST., LONDON, W.1.**

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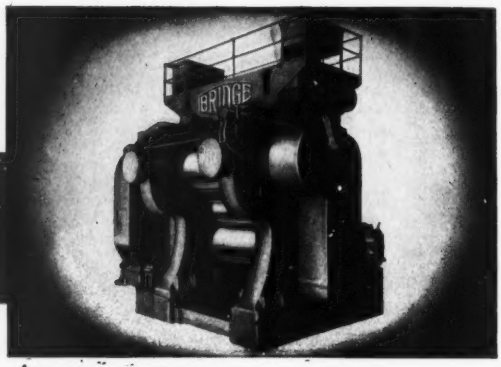
Precision Calender with three superimposed and one offset roller. Flood lubrication.



The Hallmark

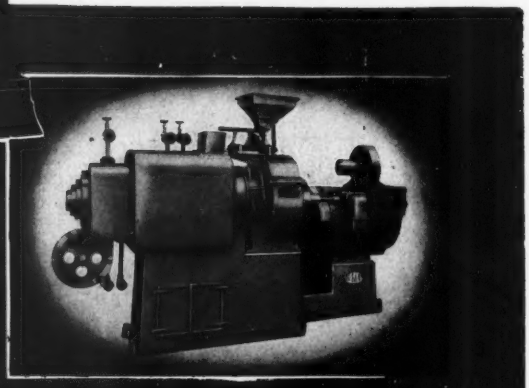
of DESIGN, SERVICE and PERFORMANCE *in* RUBBER AND PLASTICS MACHINERY

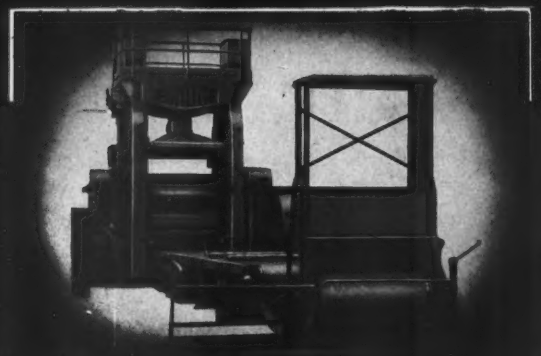
The Bridge — Banbury Patent Mixer. (1)

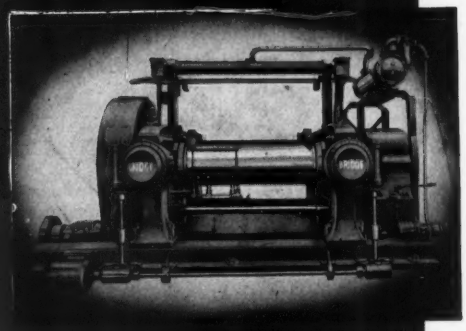
Precision Calender with four superimposed rollers.. Flood lubrication. (2)

4½" Cold Feed Plastics Extruder. (3)

High temperature 22" x 60" Plastics Mill with flood lubrication. (4)







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PROPRIETORS: TEMPLE PRESS LIMITED

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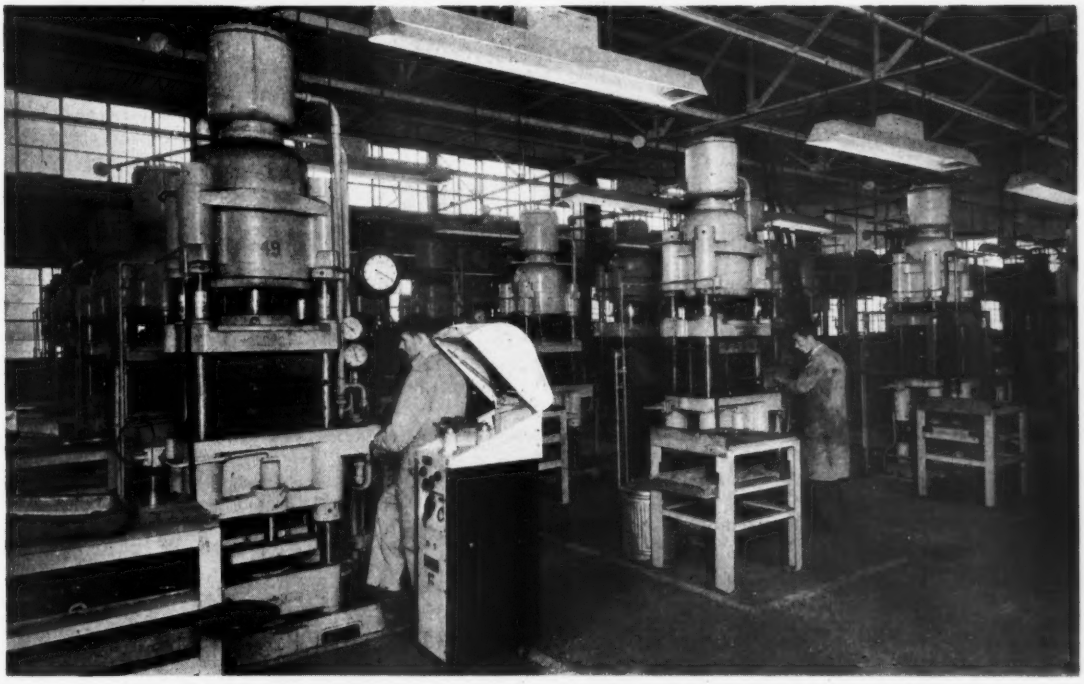

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BM161

MOULDED PLASTICS for the new Ega Spraygun

Yet again the distinctive properties of moulded plastics find their place in a new industrial development — the Ega Spraygun.

Moulded Products Ltd. of Birmingham have developed and produced the six moulded parts of the motor housing and pistol grip which provide strength, lightness, electrical insulation and a fine, smooth finish to these essential components.

The two National Plastics companies, in London and Birmingham, have design and development specialists always available to collaborate with manufacturers in the proper use of all types of moulded plastics.

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Plastics

VOL. XVII. No. 175. FEBRUARY, 1952

"A new material and manufacture 'Parkesine' now exhibited for the first time, has from its valuable properties induced the Inventor to Patent the discovery in England and France, and to devote his attention for the last ten years to the development of the capabilities and application of this beautiful substance to the Arts. . . . It can be made hard as ivory, transparent or opaque, of any degree of flexibility, and is also waterproof; may be of the most brilliant colours, can be used as a coating to a great variety of substances; can be spread or worked in a similar manner to india rubber, and has stood exposure to the atmosphere for years without change or decomposition. And by the system of ornamentation Patented by Henry Parkes in 1861, *the most perfect imitation of tortoise-shell, woods, and an endless variety of effects can be produced."*

Description of "Parkesine," Prize Medal Exhibit by Alex. Parkes of Birmingham, patentee, at International Exhibition, 1862.

EDITORIALS

Cost of Exhibitions

DURING this early part of the year, with the B.I.F. and so many other exhibitions looming ahead, the whole subject of their worthwhileness is again being discussed.

There is first the cost of the stand, which has risen so much, for we enter the field of wood, building-board, cardboard, paper, painting and printing, where prices have soared more than in most other fields, where the full impact of employment of what is often casual labour in the form of electricians and carpenters is felt, and where one's own employees are not permitted to make a light extension or drive a nail in a piece of wood without incurring the wrath of the reigning gods. Even with clear-cut decisions as to the design and layout of the exhibits, there is ever a hair-raising rush at the last minute of the extremely short period available for construction. By the time it is all complete—and many of us know that the work has often gone well into the opening day—the worry has caused the individual who has supervised it to grow a few more grey hairs, and it has cost the company anything between £250 for a very small, almost-hidden corner to some £3,000-£4,000 or more for a larger visible one. Some, we are sure, are left wondering whether the purchase of a couple of second-hand Rolls-Royces would not be a more useful method of publicity and one of considerably greater permanence.

Some of the companies who are extremely lavish with their expenditure go into it with their eyes well open and from experience find it well worth-while. Others do not find it worth-while, but continue doing so for the sake of "prestige." At the other end of the scale, there appeared two years ago the somewhat revolutionary type fostered by the British Plastics Federation, the building of a number of closely located "windows" for some 20 or 30 of its members. These, each little more than 1 sq. yd. in area, occupied one large stand. Their value vis-a-vis that of the normal stand has never been made public, although the actual cost to the exhibitor must have been proportionately small. However, while no single exhibit could have permitted much individual expression or show such great variety of manufacture, one important fact emerged—20-30 individual manufacturers were willing to co-operate under exactly equal conditions.

We come thus to a system which, a well-known executive in the plastics industry tells us, is used on the Continent. It also is carried out on the group system, but the stands are neither necessarily small nor necessarily equal in size. The whole is conceived by one designer and cost is kept low by the adoption of many common denominators; the clever use of colour avoids sameness and monotony.

This brings us to the important announcement by the British Plastics Federation that Mr. Andrew Reid has been selected as publicity agent of the Federation; the creation of the post has been urgent and the choice of agent a fortuitous one. We do not doubt that Mr. Reid will be asked to work on the problem of exhibitions.

We cannot leave this subject without reminding our readers that one of the simplest and most effective forms of exhibition, that of taking over the rooms of a hotel, must also be of relatively low cost and convenient. The Harrogate Toy Fair of 1951, stationed in two hotels, was tremendously successful, and we believe that the 1952 Fair recently ended was also fruitful, despite the rather dismal forecasts. Necessarily, such hotels are available only during their slack period, that is in winter, when travel is not always a pleasure.

Reinforced Plastics

SOME months ago we remarked on the new American segregation of the term "Reinforced Plastics" to mean those made from glass-fibre and polyester resins to the exclusion of those using any fibre or fibrous material and any synthetic resin, such as phenolics, ureas, epoxy-resins, silicones, etc. While we would all agree that the glass-fibre-polyester type is in a class of its own, since it is in the special low-pressure, no-heat category, yet we do not yet know how the U.S. plastics industry classifies the remainder of the fibre-resin groups. Perhaps the simple reason for the segregation is that there are now about 30 companies utilizing fibre-glass-polyester exclusively and it is desired to unify them for mutual interchange of technical and other problems. It is also certain that this special industry will expand greatly. Already production in the U.S.A. by some 10 manufacturers has grown to about 6,000 tons per annum.

In this country, the entire reinforced plastics industry is very strong, and is growing steadily. In the phenolic paper-laminate field we have some of the most up-to-date equipment in the world and the compressed resin-impregnated wood has also increased in production. A well-known manufacturer of the last-named type has increased the number of his factories to three in different parts of the country, one of his recent outstanding productions being submarine accumulator cases that satisfactorily pass Admiralty specifications for

resistance to exceptionally high and sudden stresses. Another type of reinforced plastic structure is the phenolic-asbestos type used in chemical plant construction, and the newer phenolic-asbestos mat form that has been so much in the news in the construction of aircraft wings, and, so far as we know, used only in this country. If urea resin glues are considered as reinforcements, we are in the rare position of being stronger in this field than the U.S.A. As for the newest of all, the epoxy resins, we have one factory in the country and presumably, with the announcement of the Shell company's work in this field, we shall have others.

Polyesters are being made by two manufacturers in Great Britain, about 90 per cent. of the production being diverted to aircraft component construction. The remainder is consumed by electrical companies, a few boatbuilders and fishing-rod makers. An interesting prototype omnibus top has also been made using polyesters. All the foregoing examples are based on fibreglass.

MOULDING POWDER AND SHOT

Polymer for Soils

Research leads us into strange fields. The latest example is the discovery by Monsanto Chemical Company of U.S.A. of a compound made from acrylonitrile, which has the valuable properties of improving soil structure so as to permit natural nutrition through air and water, etc. It is a substitute for natural humus and as such will prevent erosion; it has been given the name "Krilium." Its value has already been proved on laboratory and larger scales, and if this is finally confirmed, its discovery may well be the answer to the adequate feeding of a rapidly growing world population. Acrylonitrile is used for the production of synthetic rubbers and plastics, and all I ask is that some be left us. "Don't forget the diver!"

* * *

Abracadabra

Members of the Midland Sub-section of the British Plastics Federation have found a remarkable way of entertaining themselves and their guests at their annual luncheons. Instead of asking a well-known individual who knows nothing about plastics to tell them all about their own industry or a famous politician to give them the horrors, they prefer to enjoy themselves by listening to a man who knows a lot about his own job or hobby and who is willing to talk about it. I was invited to go along to the Grand Hotel at Birmingham on January 23, where everybody had an excellent lunch and an instructive and highly amusing time. For the guest speaker was Mr. Willey, famous local photographer and a magician of note—he is a member of the Magic Circle and of many other societies connected with magic. For an hour he kept us entranced with his History and Mystery of Magic, which ranged from the methods and secret devices of the Egyptian priests of the early dynasties to those of the seekers of the Philosopher's Stone; he told us how to decapitate a lady's body without too much damage and nearly gave us the secrets of thimble-rigging and thought-transference. With all their sacred and profane trickery, there is no doubt a direct link between the early magicians and their use of elementary chemical and physical knowledge and mechanical devices, through the later alchemists such as Basil Valentine and so to the modern scientist. Mr. Elliott, who thanked the speaker for his talk, elaborated this by emphasizing the modern magic of the chemist in evolving a series of plastic compounds that had so greatly affected the face of modern industry and everyday life. We all cheered.

* * *

Analysts at Work

On the return journey to London, six of us packed ourselves in a carriage which already contained a large-sized U.S. top-sergeant. On the luggage rack above him was his rather swagger suitcase fitted with a transparent handle which excited us all. Each of us fiddled with it in turn and obtained sufficient metallic tinkle out of it to pronounce it unanimously as of polystyrene. My detective friend Philo (Wimseycal) Bones, who as ever was with me, was rather disgusted at this crude, non-academic decision. He cut off a tiny bit and retired to the adjacent lavatory for a couple of hours (he always carries in his hip pocket sufficient analytical apparatus for such jobs and a copy of Plastics Institute Monograph No. 20). When he returned, after a few heated words with a ticket inspector, he gloomily confirmed our good guess-work. So there you are, a new polystyrene job for the British market which we all thought a rather surprising one. There was no doubt as to its strength and general suitability, for the aforesaid top-sergeant told me that the bag weighed about 35 lb. full and that he had dragged it from Denver City and all points east, to Norfolk, Virginia, and thence across the Atlantic. He didn't look as if he treated his luggage very delicately.

* * *

Plastic Stress

My idol, Ivor Brown, whose word-books have given me so much pleasure and instruction, has at least one foot of plasticine and a strange taste. In his "Having the Last Word," he defines the word "plastic" thus: "The adjective plastic means having the power to mould or shape, but modern science has turned it into the stuff that is shaped. Now the word probably signifies to the average person a frozen kind of elastic—and those plastic teacups do give a rather rubbery taste to their contents. Or at least they seem to do so. . . . No doubt the younger teachers of to-day can hardly construe the word plastic except in manufacturer's terms. . . . But in the past it was an essentially active force. Shelley saw the One Spirit's 'Plastic stress' sweep through the dull, dense world." Perhaps Ivor Brown will yet be consoled by the new plastic stress that has swept dullness from the dense world. But I wish he hadn't used the adjective elastic to mean rubber.

* * *

New p.v.c. designs

My remarks last month on the excellence of new designs on p.v.c. have brought me a sample of what I meant from BX Plastics, Ltd. It is one of their "damask" designs for handbags on completely black p.v.c., the effect being obtained by close, fine "hatchings" scattering the light in a most effective manner. It is gratifying to note the considerable advances made in recent years in the production of rolls for the purpose. It is a pity that the reproduction here, while an excellent photograph,

cannot catch the true "damask" effect. I found the same fault in the reproduction of another "damask" design sent me by Vinatex, Ltd., and reproduced in our June, 1951, issue. The camera cannot see what the moving eye sees.

DOGSBODDY.

Planned Production of Laminates

The full-scale production of decorative and industrial plastics laminates by Thomas De La Rue and Co., Ltd., in one of the largest plastics factories in Europe, has been planned as one continuous sequence of operations. This illustrated account traces the incoming materials through successive stages of manufacture, emphasizing the frequent control and inspection of materials, plant and products.

A NUMBER of sheets of paper or fabric are impregnated with a synthetic resin and consolidated under heat and pressure to form a strong, durable plastics laminate. This over-simplified definition conveys little or nothing of the chemical and engineering problems that enter into actual manufacture of these special industrial and decorative structures. During a visit to the Plastics Division of Thomas De La Rue and Co., Ltd., we were able to examine the complexities of what must be one of the world's largest, most modern plants, operating at a production rate of 500 tons per month—a rate which is indeed mass production.

This factory, standing on a 50-acre site at Tynemouth, near Newcastle, occupies 220,000 square feet. It was built immediately after the war by De La Rue, working in collaboration with the Formica Co. of America. The main emphasis in the planning of the factory was to ensure a steady, natural flow of materials at all stages of manufacture from one shop to the next, with the minimum of handling and transportation, and consequently with greatly reduced risk of contaminating materials. The chart indicates this planned flow right through the factory.

Products

The laminates produced at Tynemouth fall into three major groups.

The trade name " Delaron " covers about a dozen industrial phenolic laminates with paper or fabric fillers. The paper base grades generally have excellent electrical properties and are widely used on insulating and structural materials in electrical apparatus.

The fabric base grades, although more water-absorbent, possess higher impact strength and are consequently used for gear wheels and other applications requiring good mechanical properties.

" Formica " is a decorative laminate made in a large variety

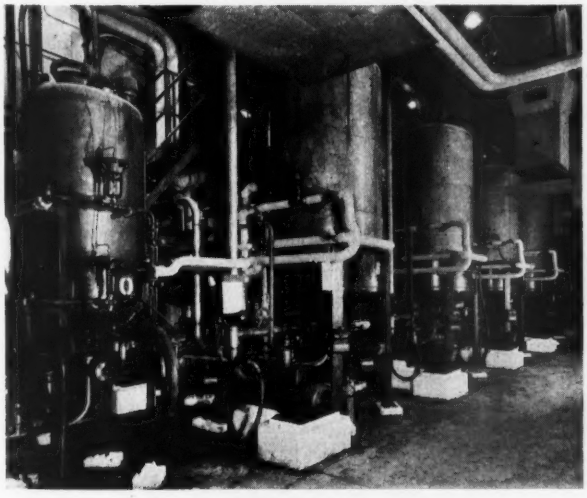
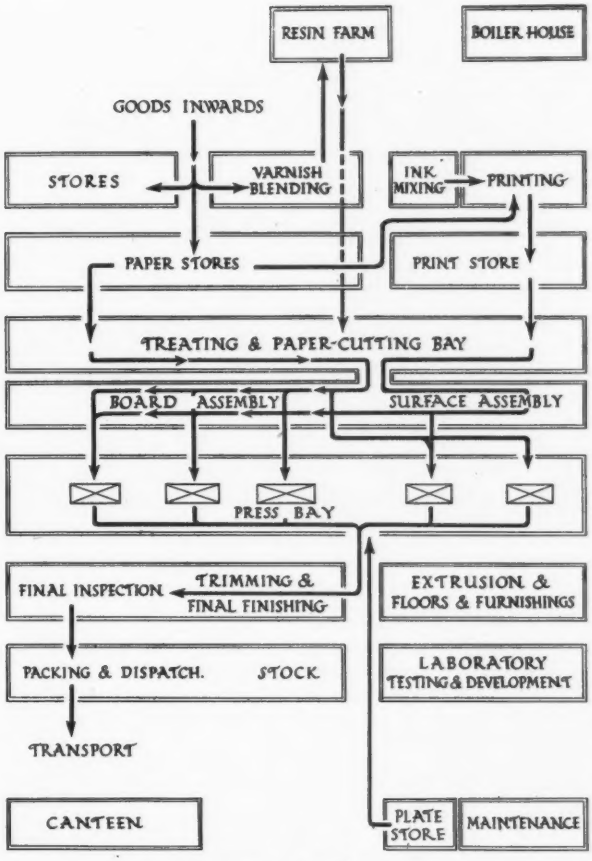


Fig. 1.—Varnish blending tanks.



Diagrammatic plan of the Tynemouth factory, indicating the flow of production.

of patterns and colours with a very hard, durable surface provided by a top coat of melamine resin. Its many uses in building, furniture construction, etc., have frequently been described in " Plastics."

" Traffolyte " is another grade of decorative laminate in which the melamine surface of " Formica " is replaced by urea resin, giving a cheaper but less hard-wearing face. It is recommended mainly for applications such as panelling for walls and ceilings where decorative value is more important than the protective surface. " Traffolyte " is also used to fabricate two-colour plaques and notices. By cutting the required letters or signs into the light-coloured surface, the dark core is exposed, leaving a clear, permanently engraved sheet.

Raw Materials

As in all industries employing chemical technology, all materials and processes must be accurately controlled, and De La Rue pride themselves on the meticulous way in which tests are carried out at all stages of production.

Paper. Paper is the principal filler material used in the laminates, textiles for high impact strength grades of " Delaron " being used in relatively small quantities. The factory uses approximately 80 tons of paper per week, and samples from each batch are tested to rigid specifications before the reels are released for production.

For general grades of " Delaron " and for the core of " Traffolyte " and " Formica," De Le Rue use a highly absorbent kraft paper consisting of pure cellulose without fillers or other foreign matter.

The paper bearing the printed decoration of " Formica " is bleached and highly filled to give great opacity in order to

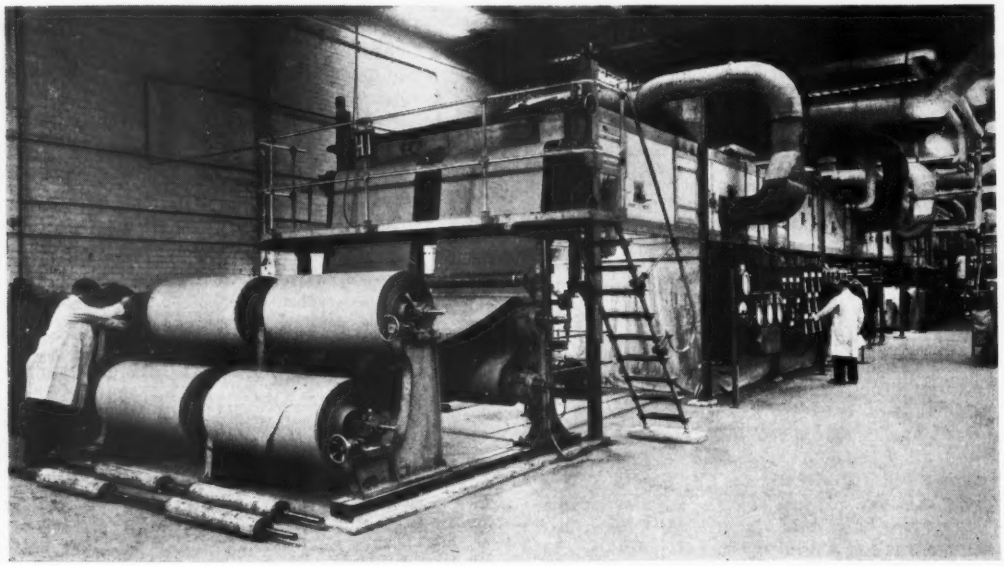


Fig. 2. High-speed horizontal resin-impregnating machine.

obscure the darker core material. A bleached, very highly absorbent paper free from fillers is used for the top layer of the decorative laminates. This, when impregnated with the hard surface resin and cured in the press becomes completely transparent to show the printed surface of the last-but-one layer in full details and colour.

Textiles. The raw material for fabric base grades of "Delaron" is mainly bleached, woven cotton material, although other fibres are occasionally used.

Resins and Varnishes. A large proportion of resins used in the impregnating varnishes are bought outside the factory, but two autoclaves, one of 1,000-gallon capacity, produce resins from basic raw materials piped directly from outside storage tanks. In the battery of blending tanks seen in Fig. 1 the impregnating resins are dissolved in alcohol, water or diluted alcohol to give varnishes with controlled resin content, viscosity and drying properties. Including those which are bought ready for use, some 60 different grades of resins are employed in the factory. The same strict control is applied in testing the resins before blending and the varnishes before they are pumped to the impregnating machines.

The principal varnishes are: phenol-formaldehyde resins dissolved in alcohol or alcohol/water mixture, used for most industrial grades and for the core of the decorative laminates; melamine-formaldehyde resins in aqueous solution, used for impregnating the top layers of "Formica" laminates; urea-formaldehyde resins in aqueous solution, used for impregnating the top layer of "Traffolyte," and meta-cresol formaldehyde resins, used for some grades of "Delaron."

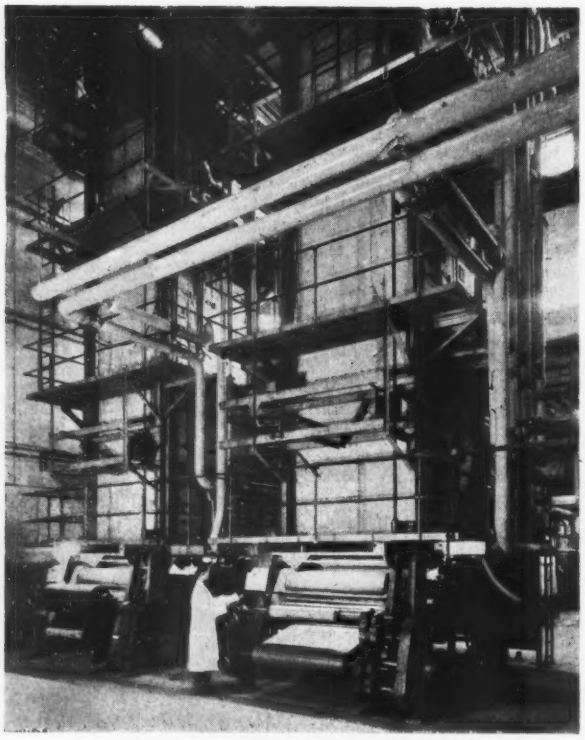


Fig. 3. Vertical resin-impregnating machines.

Varnish Impregnation

There are twelve impregnating machines in the Treating Bay. They vary in details such as their speed of operation, method of dipping, and of drying, but in each case untreated

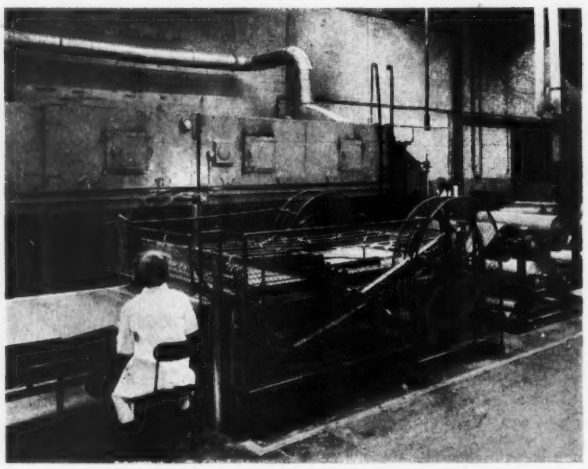
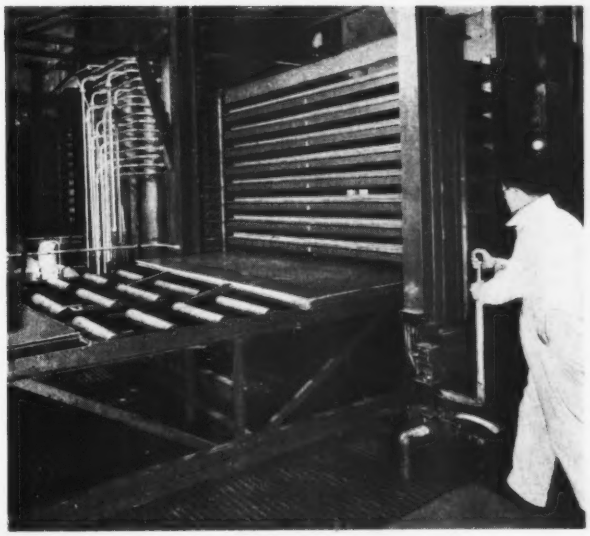


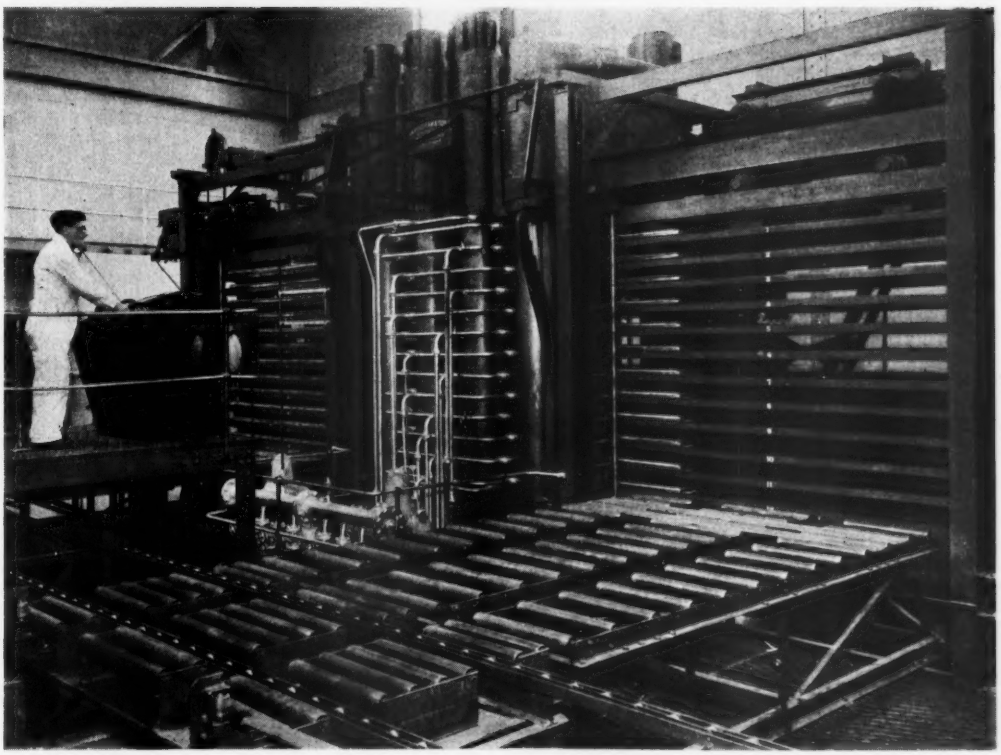
Fig. 4. Mechanical cutting of treated papers.

paper is fed from a reel in a continuous web through a varnish bath in which the fibres absorb the maximum amount of resin, after which the paper is dried sufficiently by means of hot air or infra-red driers to be reeled off ready for cutting. The high-speed horizontal impregnating machine seen from the take-off side in Fig. 2 is the largest of these. It is capable of treating paper to a maximum width of 110 ins., but in practice it is used to impregnate simultaneously two of the 50-in. reels forming the core of " Formica " laminates. Paper is passed at about 75 ft. per minute through the resin varnish bath into the 100-ft. air drying chamber. The air current through the oven is heated by the same high-pressure hot-water system which heats the presses, and the impressive control panel on the machine checks the temperature gradient in the chamber as well as the take-off speed. Every half-hour a test sample of the wet as well as dried impregnated paper stock is cut from the centre of the reel, and the reels may not be passed to the cutting machines until the control laboratory have passed the batch for production.

The decorative layer of " Formica " is printed on the two photogravure machines in the treating bay. Great care must



Figs. 5, 6 and 7.—Prepared stocks of impregnated papers and polished steel plates are conveyed from the assembly bay (left) into the press bay where the packs are loaded between successive " daylights " of the preloader (above). A 5,000-ton press with twelve " daylights " is seen (below) with the preloaders on each side and the operator at the control desk on the platform in the foreground.



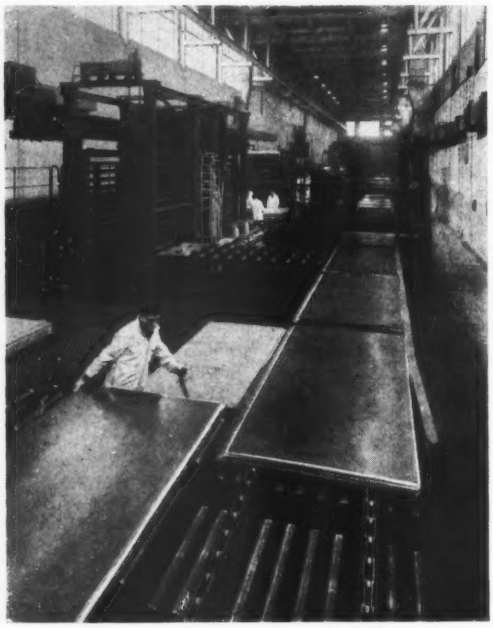


Fig. 8.—Roller conveyor taking cured laminate " packs " to the trimming shop for separation and finishing.

be taken when impregnating these papers with the melamine varnish to avoid blemishes on the printed surface. As it would be dangerous to scrape off excess resins the paper is hauled out of the dipping tank at a rate which permits the correct amount of resin to flow back into the tank. As these papers are rather fragile and because the hot air stream brings risks of dust contamination, both the printed sheet and the paper for the transparent top layer are dried by means of infra-red lamps in a vertical chamber.

Cutting and Assembling

From this stage it will be easiest to follow the process if the description is restricted to the manufacture of 8 ft. by 4 ft. " Formica " decorative laminates. The three grades of treated paper—core, decorative and protective—are cut to size by automatic guillotine cutting machines (Fig. 4), into which three or four reels may be fed simultaneously. In this condition the treated papers can be stored for about two weeks.

The next stage in the production of " Formica " is the assembly of the sheets. These are assembled so that in each " daylight " of the press, eight " Formica " sheets are produced in one cycle. The " pack " is made up as follows: a number of dry untreated sheets to act as a pressure pad; a sheet of glassine paper as separator; a set number of core paper layers; a printed sheet of melamine impregnated paper; a translucent sheet of melamine impregnated paper which becomes the transparent hard top surface of the laminate, finally a highly polished steel plate. On the top of the steel plate another set of stock sheets is assembled with the decorative layers downwards; this is covered with another sheet of glassine separating paper and another set of laminating stock. Thus by using alternate layers of glassine paper and steel plates as separators, eight panels may be moulded with only four plates.

The Press Bay

When a pack has been made up it is transferred to a roller conveyor (Fig. 5), which leads to the preloader of one of the multi-daylight presses, in the case illustrated the 5,000-ton twelve-daylight John Shaw press. The conveyor seen in the foreground of Fig. 6 is the direct continuation of that seen in Fig. 5 and leads to the preloader. This can be raised and lowered so that each pack may be pushed easily into position. There are two preloaders to each press. One team of operators can load uncured packs in whilst a curing cycle is in progress, and at the same time another team unloads the cured laminates and puts them on the conveyors to be stripped in the next shop.

The curing cycle is automatically set for time and pressure by means of revolving metal control cams cut to the requirements of the job. Heating is by means of a high-pressure hot-water system generated by mechanically stoked coal boilers. As the water circulation is completely enclosed, the same water circuit is used for cooling by passing it through a system of heat exchangers. Normal curing temperature is 150 degrees C. and the cycle is about 1½ hours. When the cycle is completed a button at the control desk opens the press and, by means of the preloader controls, the next set of packs is loaded at the same time as the cured packs are pulled out. Fig. 7 shows the cured sheets being drawn out into the nearer preloader whilst the uncured packs are ready to be drawn into the press from the other preloader.

Trimming

The cured packs of laminates travel to the end of the press shop (Fig. 8) where individual laminates are separated. The steel plates are inspected for damage, as they must be cleaned and reinforced at the least trace of a scratch or dent. The laminates are then passed to the trimming shop where they are cut to size between two high-speed circular saws. The back of the sheet is sanded to give a " keying " surface for adhesives, and the decorative surface is given a matt finish by a machine incorporating abrasive brushes.

Thermoplastics

Besides the large production of laminates, the Tynemouth factory houses two other activities of De La Rue's Plastics Division, the manufacture of p.v.c. floor tiles and the extrusion of thermoplastics. We hope to describe these processes and the manufactured products in a future issue of " Plastics."

In conclusion, we would like to thank Thomas De La Rue and Co., Ltd., for the opportunity to visit their factory at Tynemouth, and in particular to Mr. H. Kelly, Mr. B. Caws, Mr. W. S. White and Mr. D. Moore for their helpful advice and guidance.

P.V.C. Gloves and Clothing

JAMES NORTH AND SONS, LTD., of Godley Mills, Hyde, Cheshire, have sent us a useful booklet on the care and maintenance of p.v.c. gloves and protective clothing. The onus of providing suitable safety clothing, gloves and eye-protection for employees, and maintaining them in a proper state for use, rests with the occupier of any factory. His obligations are laid down quite clearly in the Factories Act, 1937, and various Orders made under that Act. The present publication provides a summary of the Orders which affect particular industries, and reprints extracts from relevant official publications. Detailed instructions are also included regarding the putting on and removing of clothing, methods of cleansing (various chemicals being tabulated with preferred methods), and maintenance. It is emphasized that the best way to encourage employees to look after their equipment is to provide the correct type of storage.

The section entitled " Protection and the Law," which deals with particular industries, extends to about half of the number of pages in this booklet. It will be noted, however, that the extracts from official publications make no specific mention of p.v.c. In the majority of instances the publications quoted were issued prior to the introduction of p.v.c. gloves and other forms of protective clothing, and users are referred to British Standard 1651/1950, which covers the replacement of rubber and leather by p.v.c. in very many instances. The attention of employers is also directed to Section 119 of the Factories Act, 1937, which states, in effect, that the employer has the right to take action against any employee who refuses to wear protective clothing which is provided and the employee has the right to insist that the employer provides suitable clothing.

The present booklet is believed to be the first of its kind. Copies are available, free of charge, on application to Northide, Ltd., Queen Street, Stockport, Cheshire, who are the distributors of North p.v.c. protective clothing.

The Extrusion of Polystyrene—II

By W. C. GOGGIN and J. N. McDONALD, Jr.

The concluding part of this article, first published in the Journal of the Society of Plastics Engineers Inc., Ohio, September 1951, treats of die design, take-off equipment, and the cooling of the extruded material.

PROPER die design is responsible to a large degree for the quality of the finished product in the extrusion of polystyrene. Indeed, much study has gone into the question of extrusion die design, but it is still largely a matter of common sense coupled with experience and the ingenuity of trial and error. For this reason, it is often desirable to make an experimental die from a soft, easily machined metal such as magnesium so that flow corrections can be easily and inexpensively made and the corrected dimensions later applied to production dies. Unfortunately, extrusion dies are seldom interchangeable from one machine to the other from the standpoint of performance, so corrections on a die should be carried out on the machine on which it is to be used. The orifice configuration does not usually conform to the cross-section of the finished part as a drawdown of 15 to 20 per cent. is desirable. This drawdown of the molten section offers one of the best methods of section and size control. In general, the die must redistribute the circular rod of molten plastic coming from the screw section to a satisfactory orifice shape.

Fig. 1 shows the design of a die for the production of a flat sheet 11 ins. wide and $\frac{1}{8}$ in. thick. The changes in section of the molten plastic which take place while passing through this die are also shown in the figure. It will be obvious that the path of the plastic coming from the centre of this thin, rectangular orifice is not as long as that coming from the edge. In other words, without any more correction than is apparent in Fig. 1, the extruded section will be heavy in the middle and thin on the edges. Consequently, it is necessary to design in the die a restriction which will increase the resistance of the flow of the plastic in the middle to equal that of the plastic flowing to the outside. Fig. 2 shows a typical form of this type of restriction. Its shape and position are largely a question of trial. An experimental forerunner of this die in operation producing polystyrene sheet is shown in Fig. 3.

Die Surfaces

The final die surfaces must have a high finish and good surface gloss if die lines in the extrusion are to be eliminated. This usually means buffing the hardened steel surfaces. The proper length of die land (the continuous, uniform section at the orifice) assists in achieving uniform flow viscosity as well as giving optimum surface characteristics. With polystyrene, a land length of from 1 to 2 ins. is usually quite satisfactory. Theoretically the land should be long enough to impart sufficient back pressure to give good flow characteristics to produce a good gloss, and to eliminate post-extrusion dimensional change. Too long a land will result in excessive internal pressures and low production rates.

A readily machinable metal such as fine grained electrical furnace steel has been found very satisfactory for die construction. Hardening is not usually essential but, if it is anticipated, the steel should have a drawing temperature above 500 degrees F. to prevent warping in use.

The control of die temperature is extremely important. A cold die or cold parts of the die give rough, uneven surfaces, while a die that is too hot results in excessive sticking. As with extruders, dies may be heated in a number of ways. Probably most dies are now electrically heated, the temperature being indicated and in some cases controlled by a thermocouple located near the plastic channel. When used for automatic temperature regulation, this thermocouple should not control the full power to the heater, otherwise excessive die temperature variations result. One widely used method is to use an indicating thermocouple with a manually variable power source such as an auto transformer or potentiometer. Wire-wound resistance heaters around the die are usually found satisfactory if good contact with the die is maintained. Heating wire embedded in heat-resistant cement is quite desirable. In Fig. 1 it will be noted that such an arrangement is used together with thick insulation over the heating unit. The importance of sufficient insulation to prevent heat losses and temperature variation throughout the die cannot be overemphasized. Many extrusion difficulties have been solved by the simple expedient of adding more insulation to the die.

Take-off Equipment

The extruder is responsible for delivering molten plastic at a uniform rate and at uniform temperature in a section approximating that ultimately desired. The remainder of the problem is the responsibility of the take-away equipment and of cut-off devices. Here again, high quality is most desirable. This equipment must hold or aid in forming the section while the plastic is cooling. Improper take-off equipment can ruin what would otherwise be a perfect extruded section.

The first consideration as the section leaves the die is to cool it properly to maintain the desired shape without

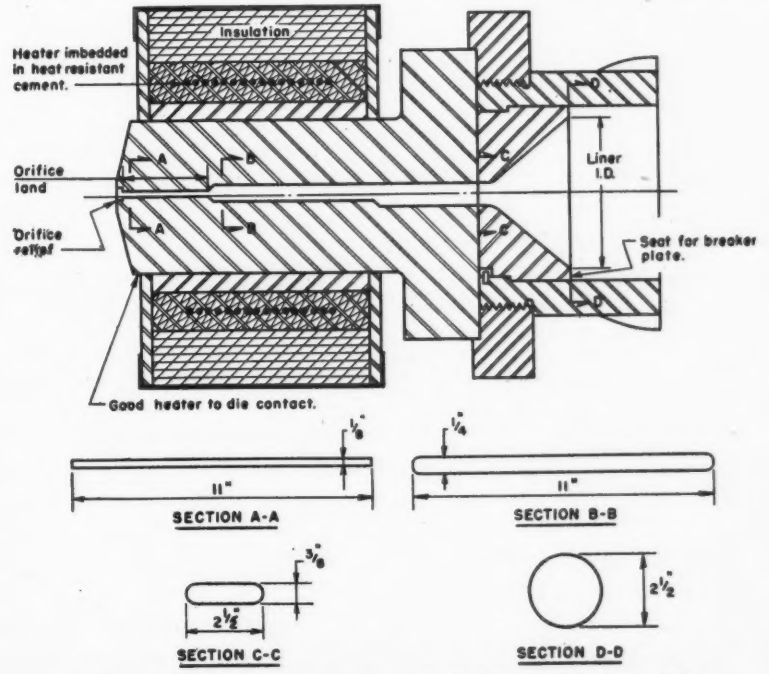


Fig. 1.—Die for production of polystyrene sheet, 11 in. wide × $\frac{1}{8}$ in. thick.

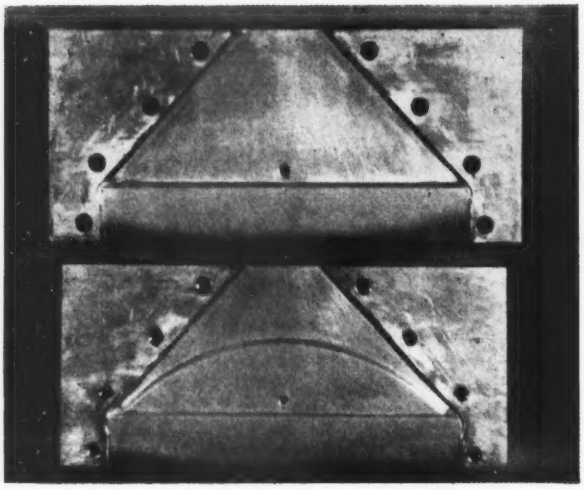


Fig. 2.—Design of die restriction to produce uniform plastic flow (shape and position determined by trial).

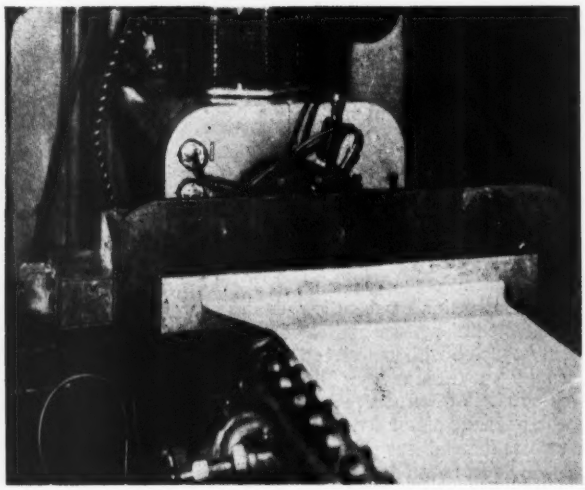


Fig. 3.—Extrusion of polystyrene sheet, 11 ins. wide × $\frac{1}{8}$ in. thick, showing the necking down between die and roller conveyor.

buckling or warpage. With polystyrene, cooling is usually accomplished in the open air with the assistance of carefully positioned air jets. Uniform cooling is particularly important in variable sections since lack of uniformity will produce distortion and bowing. Small-sized ($\frac{1}{4}$ in. to $\frac{3}{8}$ in.), easily bent copper or aluminium tubing is often used to support the hot plastic shape as it leaves the extruder and is carried on to the first part of the cooling conveyor. The tubing may be cooled to prevent the plastic from sticking by circulating water or air. Sometimes it is slotted or perforated to form air jets which support the hot plastic while it cools. The ease with which these tubes can be bent permits an infinite variety of rapid support corrections and cooling changes.

Cooling Polystyrene

Three methods of cooling polystyrene while drawing the section away from the extruder are shown in the line diagrams of Fig. 4. The first method is particularly adaptable to flat sheets and sections that are not too complex in nature. It consists of carrying the molten extruded section over free-running metal or wooden rollers while the cooling takes place. The cooling may be accomplished by convection or by air jets directed at certain portions of the section to obtain selective cooling. Fig. 5 shows an experimental flat sheet extrusion arrangement consisting of the roller-type conveyor equipment and rubber draw rolls. The draw rolls are positively driven and carry the cooled section away from the extruder at a uniform rate. Draw rolls of this nature can be used with all three extrusion arrangements shown in Fig. 4. It will be seen that arrangement "a" might well make use of contoured rolls to handle a section more complex than just a flat shape. It would also be possible to change slightly the shape of each subsequent forming roll to permit a gradual change in the shape of the section from the orifice section to the desired section while cooling takes place.

Arrangement "b" (Fig. 4) shows a second method of cooling which is often found in practice. In this method the extruded shape is carried over metal

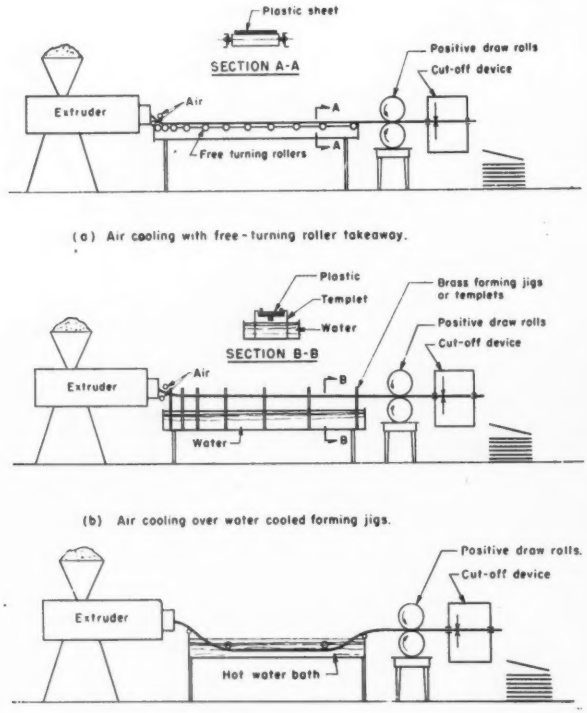


Fig. 4 (left).—Representative polystyrene extrusion methods. Diagrams showing alternative set-ups.

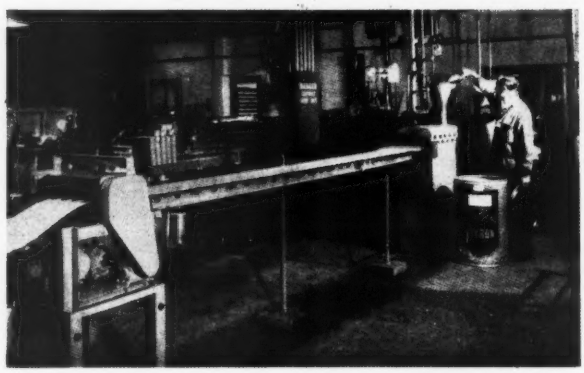


Fig. 5.—Extrusion layout for production of polystyrene sheet. Note the cylindrical roller conveyor and driven rubber roll removal equipment.

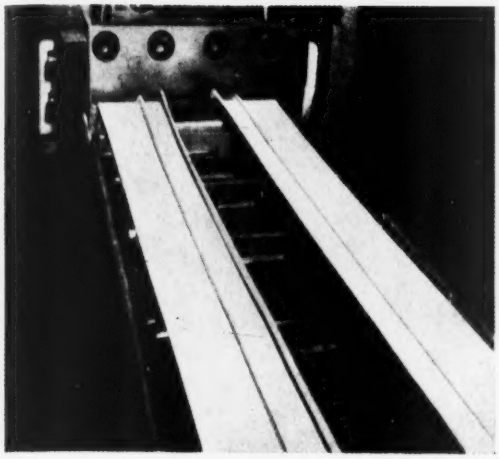


Fig. 6.—Take-off equipment based on partially submerged metal templates.

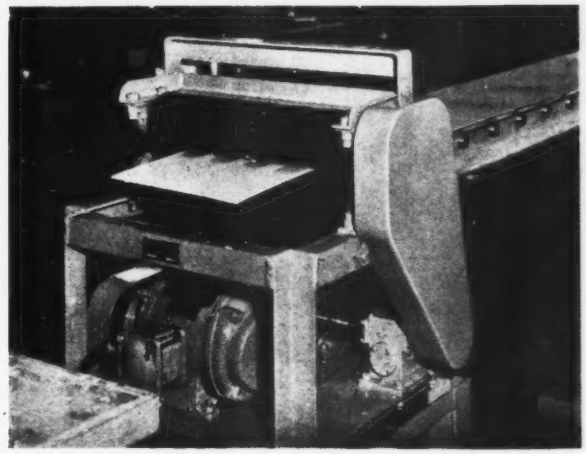


Fig. 7.—Rubber draw rolls, with positive drive. The roll segments can be moved to accommodate special sections.

templates. These templates are cooled by partial immersion in water. Again, draw rolls with a positive drive furnish the motive power for carrying the sections over the templates. Here also it will be seen that the shape of the templates can vary as the plastic carries down the conveyor in order to progressively form it as it cools. Fig. 6 shows two extruded sections coming from a double orifice die and being carried over, cooled and held in shape by the metal templates.

A third method of controlled cooling is shown at " c " (Fig. 4). It involves the use of a water bath through which the extruded section is carried. Of course, the temperature of the water bath can be varied to control the plastic cooling rates. In general, however, even with hot water, the cooling rates are more severe than those in air and often too drastic for many sections. In other words, a frozen skin may form which will not permit sufficient shrinkage so that bubble formation in the heavy sections results. Usually the use of a bath also necessitates a section which can stand some bending to enable it to dip in and out of the bath. This method is sometimes used for rods or other uniform sections.

The rate of cooling of the extruded shape is inversely proportional to the material thickness and directly proportional to the time involved during take-away; thus heavy sections or sections extruded at high rates may require long conveyor cooling devices. A usual practice in most extrusion operations is to draw down the molten section in the order of 15 to 20 per cent. by carrying it away from the extruder faster than the extruder will produce a section of the orifice size. This permits a good method of size control, but it is obvious that, assuming a uniform extrusion rate, the take-away rate must be constant if size fluctuations are to be prevented. Good extrusion, cooling and take-away equipment should be able to produce at commercial rates a flat width section of 6 ins. having dimensional tolerances of less than $\frac{1}{16}$ in. Positively driven draw rolls, such as shown in Figs. 5 and 7, provide an excellent means of carrying away the extruded section at uniform rates. These rolls may be designed and placed to conform to the extruded shape to prevent breakage or cracking. It is obvious that the draw rolls must be spaced far enough away from the extruder to permit sufficient cooling to prevent sticking or deformation of the section. This take-away device is positive and yet has a minimum of contact with the plastic. A wide speed range is necessary if the unit is to be truly versatile. This is often achieved by changing the gear-reduction unit or sheaves in addition to using the variable-speed control mechanism.

Cut-off Equipment

Most extruded sections are used in a definite length rather than in continuous lengths. Accordingly it is often desirable to cut off the section as it is being produced to make possible subsequent finishing or immediate packaging. Polystyrene is less adaptable to cut-off methods than other plastics with higher impact strength. With polystyrene, impact-type cutting tools like punch presses or guillotine knives can rarely be used if fractures and cracking are to be avoided. If this equipment is used, best results are usually obtained when it is actuated by solenoids or air cylinders. Since the impact strength of polystyrene is higher at higher temperatures, it is sometimes advantageous to cut the section before it is completely cool. Care must be exercised to prevent bending and warping when a warm section is cut. Hot scribing followed by breaking when cold, shows some promise. Heated knives or hot-wire cutting methods, while sometimes applicable, do not usually leave a clean-cut end.

In general, the most satisfactory method of cutting polystyrene is through the use of single or multiple travelling saws. A typical installation might involve the use of a flying saw attached to a sliding table. Careful timing and speed control should permit the cutting saw to contact the moving extruded section and move with the section at the same rate as it is being extruded, thus leaving a clean-cut end. When the cut is complete, the saw returns to its initial position.

Most general-purpose types of polystyrene are suitable for extrusion. The major considerations are as follow: It is important that the granulation chosen remains uniform, and that it be used with the screw having the proper compression ratio. Viscosities ranging from 30 to 70 cps. (in a 10 per cent. toluene solution) are satisfactory. Once selected, the flow properties (as determined by melt viscosity, solution viscosity, or even molecular weight and distribution) should remain uniform for consistent quality. Polystyrenes which contain proper lubricants in the formulation extrude well, while granules with an external surface lubricant often give lowered extrusion rates and possible erratic results may be obtained because the granules are so slippery that it is difficult for the screw to grip them and start them through the extruding machine.

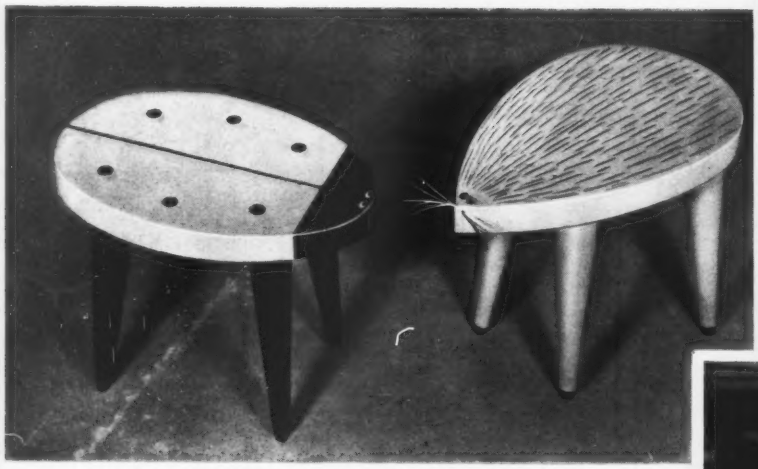
As in the moulding of polystyrene it is not usually necessary to pre-dry granules unless moisture condensation has taken place. Moisture can be as critical in the extrusion process as in moulding. If the plastic granules are heated, they can be fed to the extruder while still warm. As in moulding, pre-heating of the granules can also increase extrusion production rates.

Polystyrene is an excellent plastic for extrusion, providing care is exercised in (1) the selection of the material, (2) the design of extruder components, including the die, (3) the selection of the cooling take-away, and draw rolls, and (4) use of appropriate cut-off devices.

PLASTICS
IN THE SERVICE OF MAN

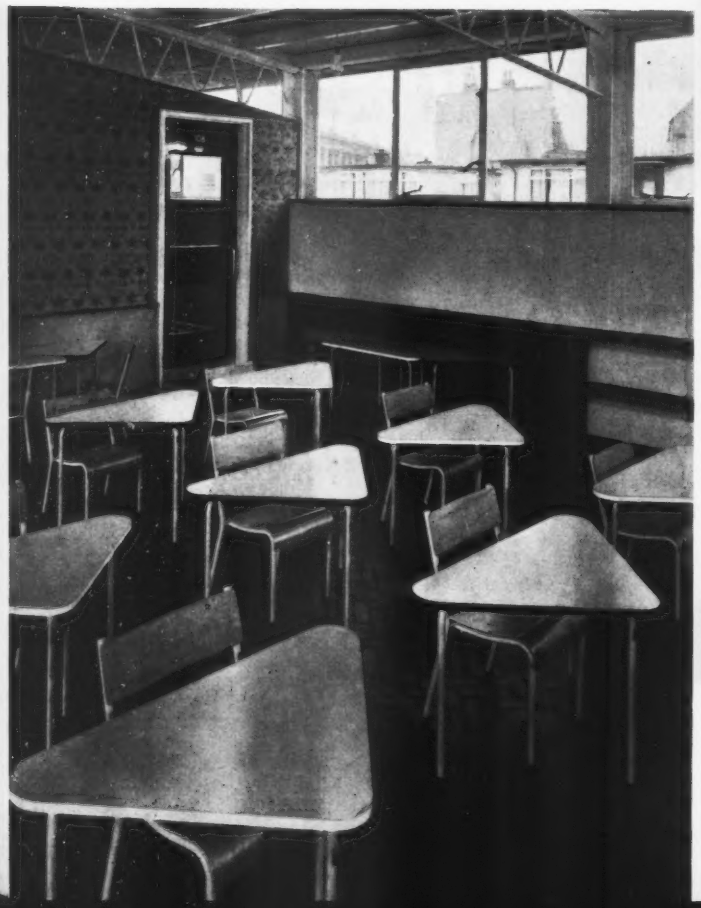
A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

25. School and Nursery.



(Above) The hard-wearing and easily cleaned surfaces of laminated plastics are particularly suitable for school and nursery furniture. The pattern on these "Warerite" nursery stools cannot be worn away as it is embedded below the surface of the laminate. (Photo: Warerite, Ltd.)

(Above) This mobile practical lecture desk, constructed of 1-in. "Holoplast" cellular plastics panels (Holoplast, Ltd.), was designed by Bertram Carter for the Nurses Home at Lewisham. The removable top conceals a sink with gas, electrical and water fittings. (Photo: Architects' Journal.)



(Above and left) The tables in the two classrooms of the new Susan Lawrence Nursery School in Poplar, London, have been veneered with "Formica" laminates made by Thomas De La Rue and Co., Ltd., Plastics Division.

(Left) The internally illuminated globe by Geographia, Ltd. is constructed entirely of cellulose acetate mouldings made by J. F. Kenure, Ltd. ("Plastics," August, 1951, p. 239.)

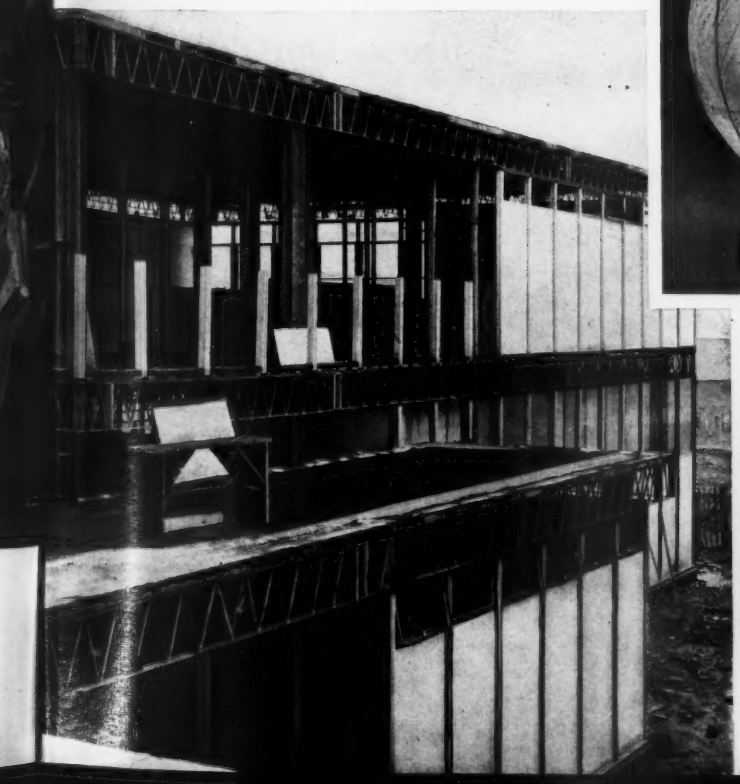
(Above) Tables in the dining hall of King Edward's School, Whitley, Surrey, surfaced with linette "Formica," are neat, hard-wearing and easily cleaned. (Photo: Thomas De La Rue and Co., Ltd.)

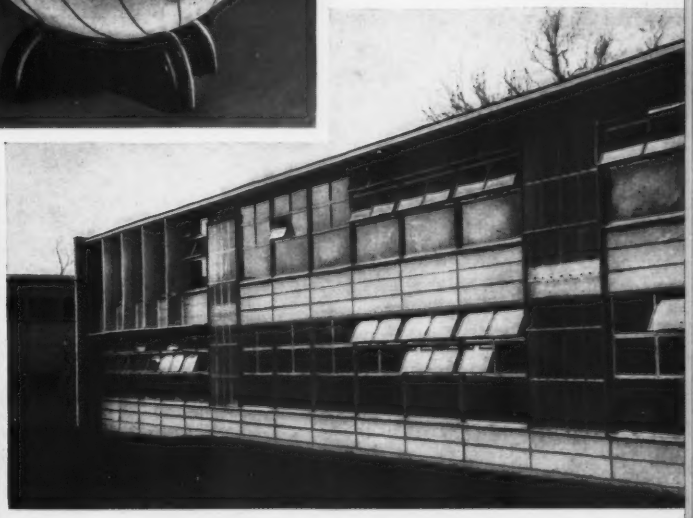
(Below) Geographical globe made by Georama, Ltd., from "Perspex" acrylic sheet. (Photo : I.C.I.)

(Above) Use of acrylic sheet at Manchester Art School includes corrugated "Perspex" roof-lights for daytime and lighting fixtures by Thorn Electrical Industries, Ltd. with "Perspex" reflectors for evening. (Photo : I.C.I.)

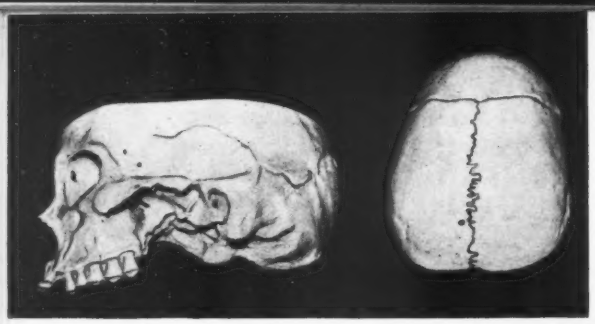
(Below) Experimental external use of "Holoplast" structural plastics at the Clarendon Secondary School, Oxley, Herts, has been described by J. B. Singer ("Plastics," Feb. 1951, p. 31.)

(Above) Aluminium frame school chairs made by Educational Supply Association, Ltd., are fitted with post-formed laminated plastics seats and backs for export to countries with humid climatic conditions.



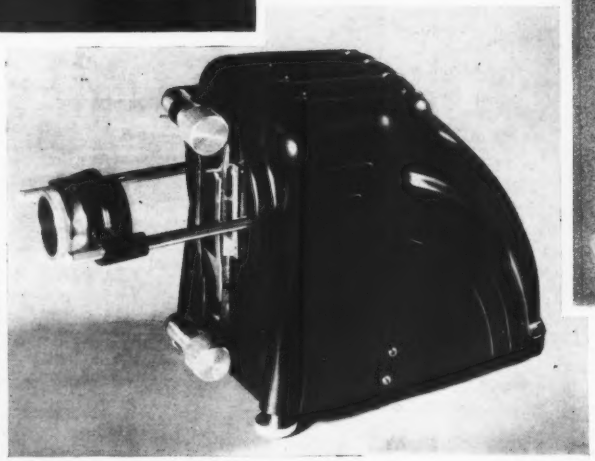


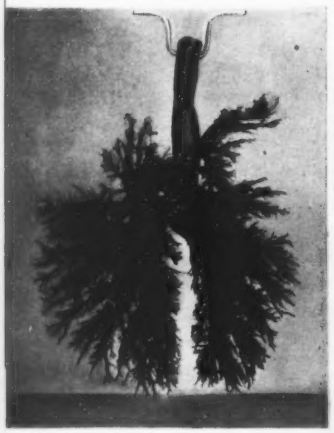
(Above) Vertical panels o corrugated "Perspex" provide a decorative feature as well as extra daylight at a Stevenage school (Photo : I.C.I.)



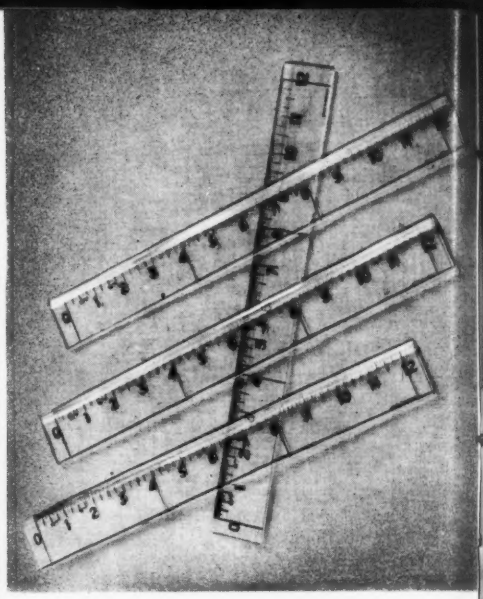
(Above) Copies of the human skull, and similar anatomical models for educational purposes, are fabricated from acrylic plastics by Educational and Scientific Plastics, Ltd.

(Below) A phenolic moulding houses the "Skolascope" slide projector made by Watson Manesty and Co., Ltd. ("Plastics," August, 1951, p. 238).

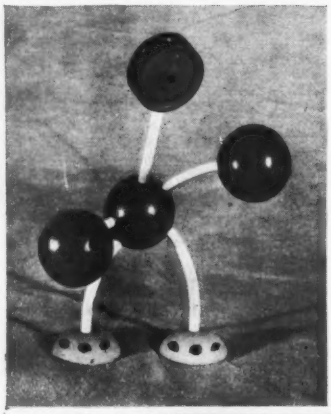




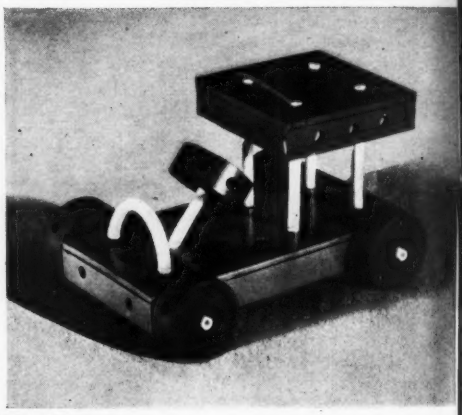
(Above) This ingenious demonstration model of a sheep's lung was made by injecting coloured "Marco" resin (Scott Bader and Co., Ltd.) into the original tissues and later washing these away. (Photo: Dr. J. T. Scales, Royal National Orthopædic Hospital.)

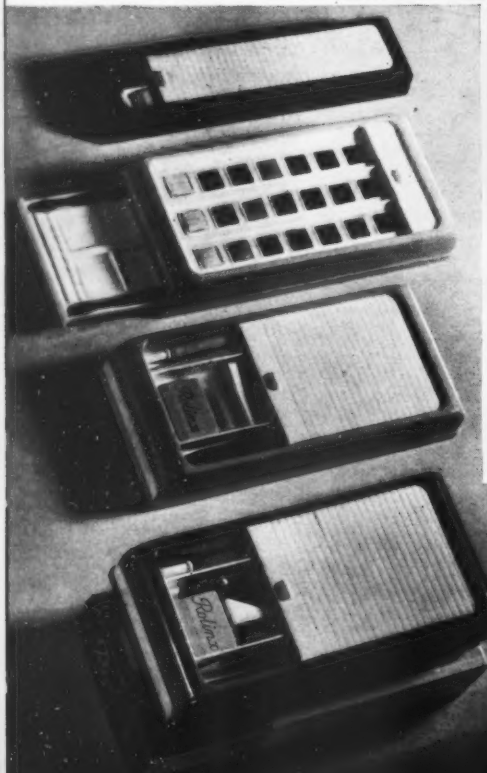


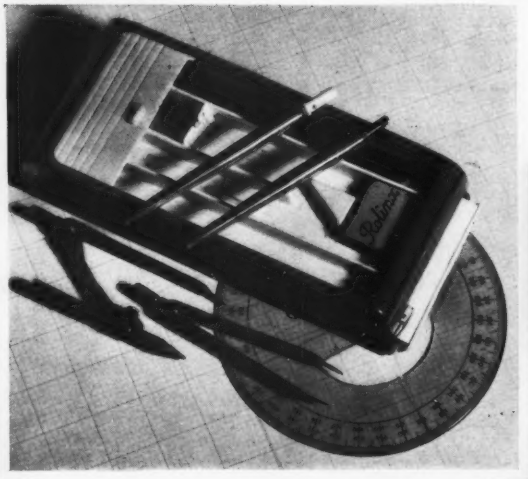
(Above) Transparent "Perspex" is now a commonly accepted material for the manufacture of rules and geometry instruments. (Photo: I.C.I.)



(Left and right) Mouldings and extrusions of cellulose acetate make up the constructional set manufactured by E.V.B. Plastics, Ltd.

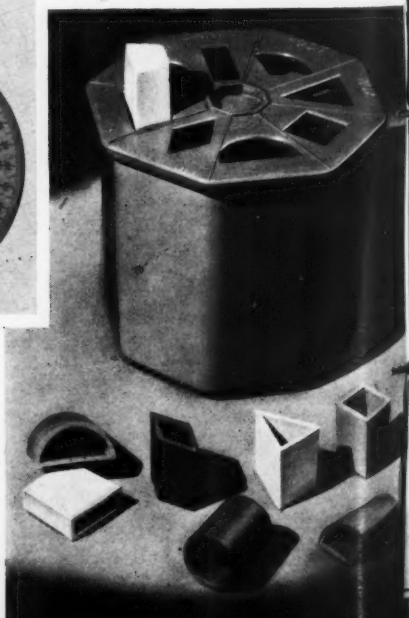






(Above and left) Mouldings of polystyrene and extrusions of cellulose acetate butyrate (Tenite II) are made by Rolinx, Ltd., for use in their set of novel roll-top boxes for paints, pencils, geometry sets, etc.

(Below) Educational toys used in nursery schools include this "post-box" made by Dandy Toys, Ltd.

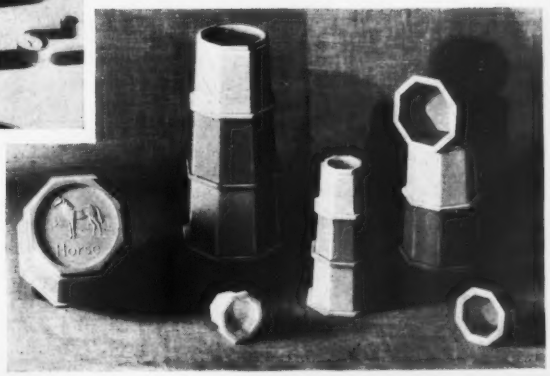


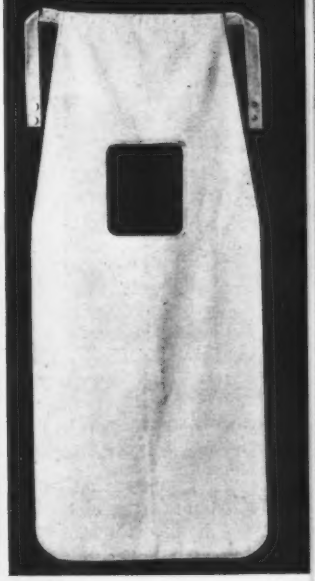
(Above) Range of plastics educational toys made by Kiddicraft, Ltd. help children to learn the alphabet, numbers and weights. ("Plastics," December, 1949, p. 130)

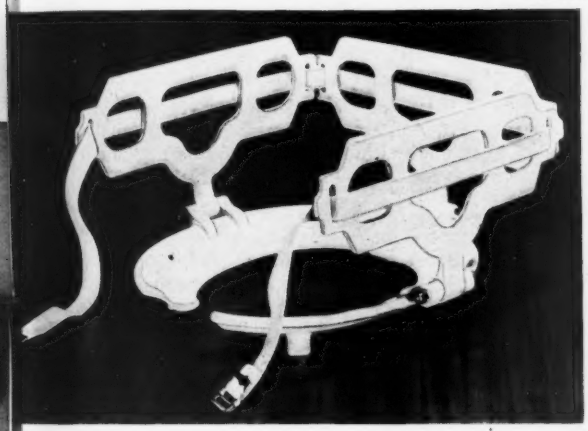
(Below) Children's lavatory seat with folding frame made by Robert McArd, Ltd.

(Right) This p.v.c. apron fitting over the shoulders is made for Educational Supply Association, Ltd. for use in water play at nursery schools.

(Below) Play blocks with animal pictures, moulded in urea, are made by Dandy Toys, Ltd. ("Plastics," December, 1949, p. 130)





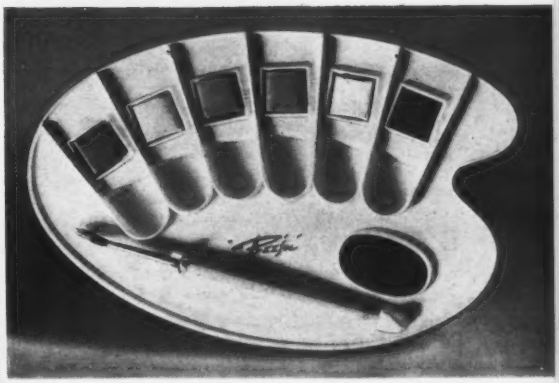


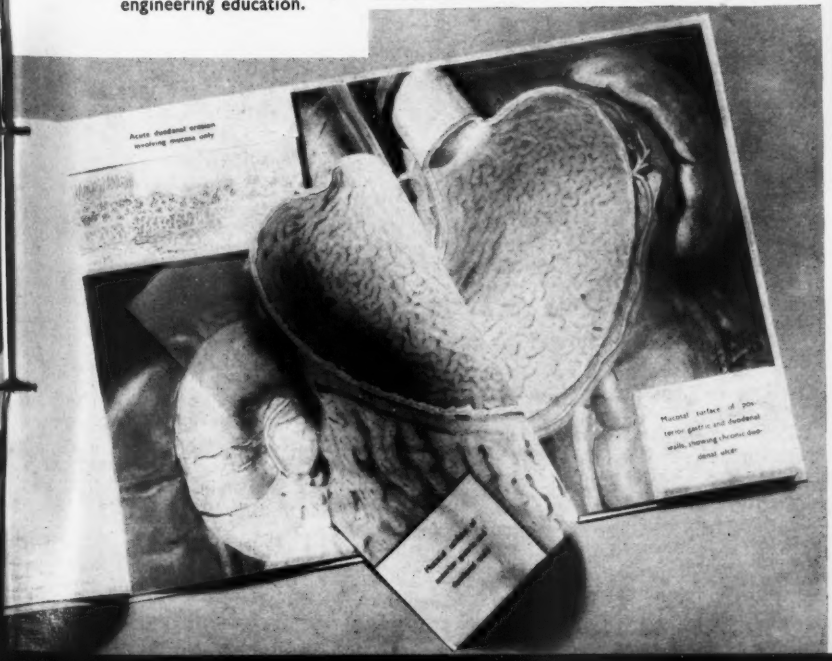
(Below) Inkwell and desk fitting with sliding lid are moulded in phenolic material by Plasmic, Ltd. for the Educational Supply Association, Ltd.

(Left) Nursery coat-hangers injection moulded by Wood and Kotek, Ltd.

(Below) Child's paint palette with water colours moulded by E.V.B. Plastics, Ltd.

(Below) Colour printing on transparent cellulose acetate film ("Clarifoil" made by British Celanese Ltd.) has enabled Transart Ltd. to develop a technique of producing sectional demonstration booklets for medical and engineering education.





(Below) Token coins for teaching in schools. Injection-moulded in cellulose acetate by Dines Products, Grays, Essex, for Philip and Tacey, Ltd. ("Plastics," June, 1951)

World's Industry Employs Plastics

INDUSTRIAL APPLICATIONS

Plastics inserts for machine tool slides are claimed to show superior wearing properties. The plastics material is reinforced with nylon, linen or silk. A 120-ft. planer with plastics slide-away insert is under construction. (U.S. Dept. of Commerce, Techn. Divn. Report IR5432.)

Impregnation of castings.—Pressure-tight castings have been obtained with the thermosetting mixed polymerisate PE.1. Technique for ferrous and non-ferrous metals as well as joint faces is discussed. (" Iron Age," 1951/No. 10/115.)

Metal-surfaced fluorocarbon sheets for dielectric applications have been developed by U.S. Gasket Co., Fluorocarbon Products Div., Camden 1, N.Y. The dielectric materials include pure fluorocarbon resins (Teflon, Kel-F) and mixtures of fluorocarbon resins with other materials such as asbestos, mica, fibreglass, glass, ceramics, quartz, calcium fluoride, etc. The metal covers include aluminium, boron carbide, copper, Alnico, etc. (" Product Engineering," 1951/Dec./218.)

Acrylic plastics for a flowmeter.—Use of transparent solid block of plastics material in a flowmeter, produced by Brooks Rotameter Co., Lansdale, Pa., eliminates packing glands and glass parts. All piping connections are bored into the block. The rate of flow is visibly indicated by the position of a spherical float in the metering tube. (" Product Engineering," 1951/Dec./238.)

Plastics moulds for an inclinometer.—K. Zibold describes in detail the construction of the plastic moulds necessary for the production of an inclinometer. (" Betrieb und Fertigung " (Austria), 1951/Dec./198.)

Properties and applications of condensers of " Styroflex."—Condensers of a high degree of constancy of capacity have been made of polystyrene. (" Elektrotechnik," 1951/Oct./239; abstr. in " Feinwerktechnik," 1951/Vol. 2, No. 55.)

Polythene ware in the laboratory.—A survey is given of various types of beakers, funnels and bottles in production. (" The Laboratory," 1951/ Vol 21/ 42.)

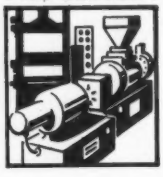
Plastics versus metals in bearings.—R. H. Warring compares the physical properties of bearing metals with those of plastics bearing materials and stresses the application for rollneck and water-lubricated bearings. (" Mechanical World," 1952/Jan./26.)

Plastics in the motor industry.—The influence of the defence programme on body design is discussed by J. G. Slater, referring to older and newer materials of the plastics family. (" Automotive Industry," 1951/Dec./52.)

Development of small parts.—R. J. Bibbero and E. B. Chester show how plastics help in miniaturization. This is achieved in particular by embedding metal parts in plastics. (" Machinery Design," 1951/Oct./127.)

Plastics for chemical plant.—A. E. Lever reviews the application of polyvinyl chloride for pickling tanks and flooring. (" Wire Industry," 1951/Vol. 18/783.)

PROCESSES : MACHINERY



New machines.—A detailed and well-illustrated survey is given on new machines and testing plant for plastics. (" Gummi and Asbest " (Stuttgart), Vol. 4, 1951 (No. 10), pp. 363-375.)

Forming of Thermoplastics. — H. Pischke gives the principles of hot forming, methods of heating and moulding methods. (" Schweissem und Schneiden " (Braunschweig), 1951/Vol. 3/263.)

Machining of " Plexiglas." — A. Nicolas gives some useful hints on the machining and includes a table on diametral tolerances. (" Machine Moderne," 1951/Oct./65.)

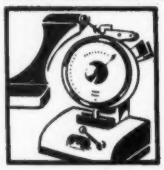
A long-life drill for plastics has been designed by R. Double, having an undersize cylindrical shaft and two notches in the drill tip. Its life is three times that of conventional drills. (" Canadian Machinery and Manufacturing News," 1951/Nov./133.)

Difficulties in the production of vinyl plastics.—W. Schwab deals with decomposition, problems of stabilization and their solution. (" Chemische Rundschau," (Solothurn), 1951/Vol. 4, No. 20/269.)

Machining of laminated plastics.—L. C. Rowland gives the recommended practices for sawing, shearing, punching, drilling and broaching of laminated plastics containing asbestos, glass and graphite. (" Materials and Methods," 1951/Nov./82.)

Polyethylene cable splice.—New installing and splicing techniques had to be developed for polyethylene insulated cables with an outer " Vinylite " jacket. (" Electrical World," 1951/Aug. 13/130; " McGraw Hill Digest," 1951/Dec./54.)

MATERIALS and TESTING



A blend of plastics with aluminium foil made by Reynolds Metal Co., Richmond, Va., is said to represent a substitute for tin. Aluminium sheets are coated with plastics and bonded under heat and pressure. Production is said to be starting immediately. (" Materials and Methods," 1951/Nov./112.)

Translucent plastics sheeting developed for a variety of structural and decorative applications is available in six standard colours. It is claimed to be shatterproof, but eliminates glare by diffusing light. (" Materials and Methods," 1951/Nov./120.)

A " colour Index " for floor tile resins.—B. A. Reeves suggests replacing visual rating by a photoelectric photometer and considers the suitability of the General Electric " Luximeter." (A.S.T.M. Bulletin, 1951/Dec./62.)

Plastics from fish protein.—J. Ugelstad deals with problems, tests and economic possibilities of a new raw material. (" Tekn. Ukeblad (Oslo) " 1951/Vol. 98/749.)

Evaluation of the degree of gelation of p.v.c. base leathercloth.—A. Kling observes that the mechanical strength of plasticized polyvinyl chloride films depends to a large extent on the degree of gelation, and a rapid and simple method of evaluating this is attempted. (" Kunststoffe," 1951/Aug./240.)

MISCELLANEOUS USES

Plastics for internal fittings in motorcars are described in an American journal. Article deals with various types of plastics for seats and internal decoration, properties and trends. (" Amer. Automobile," 1951/Vol. 28, No. 10/p. 32.)

Composite insulation with polyethylene and nylon.—J. E. Flood discusses the coatings used on assault wires, in particular WD-1 type, a Signal Corps wire extensively used in World War II and the present Korean war. (" Wire and Wire Products," 1951/Nov./1040.)

Polyvinyl chloride films for Gamma-ray dosimetry.—When a p.v.c. film is exposed to gamma rays, HCI is liberated and the colour of a dye in the film is altered. (" Nucleonics," 1951/Dec./62.)

Ethoxyline Resins—II

By Dr. E. PREISWERK

This account of the Ethoxyline Resins is continued from our January 1952 issue. It was the subject of one of the lectures at the Summer School held at Cambridge by Aero Research Ltd. to study technical applications of synthetic resin adhesives, and is published in these pages by kind permission of CIBA Ltd. and the author.

THE outstanding characteristics of ethoxyline resins as bonding agents, the small degree of shrinkage on setting, high heat resistance, remarkable mechanical and dielectric values, and simple methods of application meant that electrical engineering could now tackle problems which hitherto were out of question. One of these was the technique known in English as "potting." Similar developments are taking place with polymerization resins, such as the so-called polyesters. It has, however, been reserved for the ethoxyline resins—thanks to their bonding properties, their small degree of shrinkage on setting, among other characteristics—to start developments which have yet to be fully investigated.

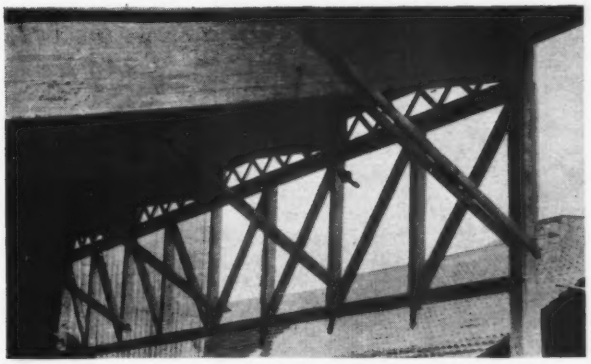
If we survey these different tendencies the idea of a "bonding agent" must be taken somewhat further, and in particular where "Araldite" resins are concerned—so long as the bonding and casting resins are in question—it would probably be better to talk of "uniting agents."

The characteristics of a selection of resins which are designated as "casting resins" has already been summarized in the previous instalment of this article ("Plastics," January, 1952, page 6, Fig. 1). Included are "Araldite" casting resin B and three provisional types. In this case we also have the subdivisions of hot curing and cold curing products. Resin and hardener are separate in all cases. Resin B is delivered in lump form; provisional products F and D are liquid resins. Hardeners 901 and 911 are solid; hardener 951 and accelerator G are liquid.

Whereas casting resin B is suitable for the manufacture of castings and also for "potting," the other new resins exhibit other properties, such as long pot life (for mass or chain production), low casting temperature (for sensitive materials), low viscosity (so that the resin fills the smallest gaps), and casting and hardening at normal temperature.

Table 1 sets forth data on "Araldite" casting resin B, in comparison with other synthetic resins which on account of comparable applications are similar; for instance, phenolic, polyester, allyl acrylic, and polystyrene resins.

First of all, there is adhesion to surfaces, which is almost exclusively the property of "Araldite." Another important factor is shrinkage during the curing, which in the case of "Araldite" is very small. Tensile and flexural strengths show good values and the impact strength is very high. Density, hardness and the linear thermal expansion are normal, whereas the heat distortion or Martens point is remarkably high. The water absorption is greater than that of polystyrenes but less than that of the other resins. The permeability for humidity (diffusion constant) is remarkably low. The dielectric strength is normal, whereas the volume resistivity is higher than that of phenolic resins. Dielectric constant and dissipation factor are in the region of those of the polyesters; one can



Figs. 1 and 2.—"Araldite" Type I for engineering constructions in wood/metal. The steel T-pieces are covered by a thin wooden veneer bonded to the metallic surface by the aid of "Araldite" Type I. The pretreated T-pieces are bonded by the means of a normal synthetic wood glue to the other wood construction. (Courtesy, Dr. Ing. Staudacher, Zurich and Gribi S.A. Burgdorf.)

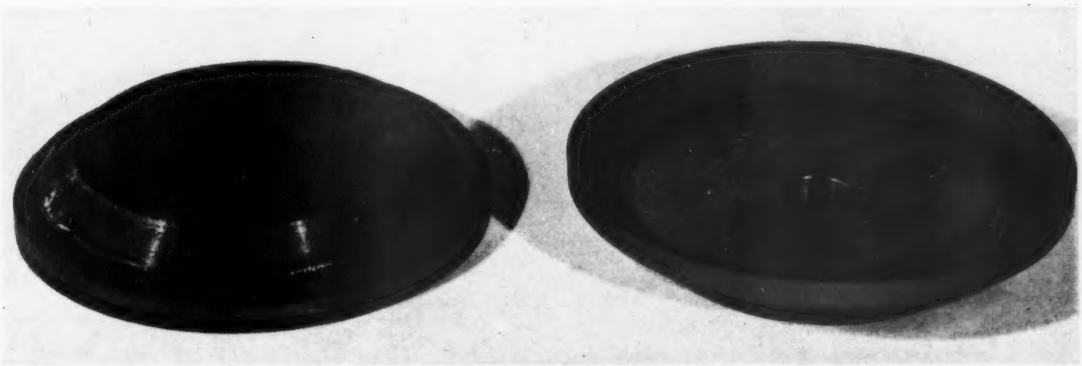


Fig. 3.—Rolling polishing discs. The hard metal ring is bonded to the steel disc by aid of "Araldite" Type I.

TABLE I.—Araldite Casting Resin B in Comparison with Other Synthetic Resins

	Test Method	Ethoxyline Resins—"Araldite" Casting Resin B	Test Method	Cast Phenolic Resins (1)	Polyster Resins (2)	Allyl Casting Resins (3)	Acrylic Resins (4)	Polystyrene Resins (5)
Storage life	—	Practically unlimited	—	Limited	In many cases limited	Practically unlimited	Monomeric product limited	—
Curing process, polymerization	—	No volatile substances are split off; no special precautions; no precise temperature	—	Volatile substances are split off; careful curing necessary	No volatile substances are split off; in many cases presence of air inadmissible; careful curing	No volatile substances; careful curing	Careful curing	—
Adhesion to the surface of different materials	—	Outstanding; no adhesion to moulds when properly pre-treated	—	None	Appreciable	Slight	None	None
Shrinkage during curing	—	0.5–2.3%	—	Greater than 1%	Varies, in some cases up to 10%	Varies, in some cases up to 10%	10–20%	10–15%
Tensile strength	A.S.T.M. D651—48 VSM 77101	6.5–8 kg./sq. mm.	A.S.T.M. D638—44 T 46 T	4.2–6.4 kg./sq. mm.	2.5–6.4 kg./sq. mm.	3.6–4.3 kg./sq. mm.	5.7–7.0 kg./sq. mm.	6.0–6.4 kg./sq. mm.
Flexural strength	A.S.T.M. D790—49 T (Schopper test bar 120×15×10 mm.)	900–1,200 kg./sq. cm.	A.S.T.M. D790—44 T 45 T D650—42 T	770–1,200 kg./sq. cm.	600–1,200 kg./sq. cm.	420–920 kg./sq. cm.	1,050–1,200 kg./sq. cm.	850–1,120 kg./sq. cm.
Impact strength	A.S.T.M. D256—47 T (Schopper test)	0.69 ft.-lb./in. (20 cm. kg./sq. cm.)	A.S.T.M. D256—43 T 45 T 47 T Izod, notched	0.25–0.40 ft.-lb./in.	0.3–0.4 ft.-lb./in.	0.2–0.4 ft.-lb./in.	0 4 ft.-lb./in.	0.25–0.4 ft.-lb./in.
Compressive strength	A.S.T.M. D695—49 T (VSM 7/102)	16,000 per sq. in. (11–13 kg./sq. mm.)	A.S.T.M. D695—44 T	—	21,300 per sq. in.	—	—	—
Modulus of elasticity	A.S.T.M. D638—46 T	25–35,000 kg./sq. cm.	A.S.T.M. D790—44 T 45 T (flexure)	20–35,000 kg./sq. cm.	20–57,000 kg./sq. cm.	20–45,000 kg./sq. cm.	28–36,000 kg./sq. cm.	35–42,000 kg./sq. cm. (tension)
Hardness	Rockwell hardness A.S.T.M. D785—48 T	M 98	Rockwell D785—44 T	M 93–120	M 85–115	M 95–119	M 96–102	M 65–75
Coefficient of linear thermal expansion	A.S.T.M. D696—44	60×10^{-6} with high percentage of extender: $25–30\times10^{-6}$	A.S.T.M. 42 T D696—44	$60–80\times10^{-6}$	$80–100\times10^{-6}$	$50–100\times10^{-6}$	90×10^{-6}	$60–80\times10^{-6}$
Heat distortion	Test by Martens (Federal L-P-406a-2011)	110–120°C. (109°C.)	A.S.T.M. D648—44 T 45 T	74–80°C.	60–116°C.	60–88°C.	90–100°C.	95–100°C.
Water absorption	A.S.T.M D570—42	0.14%	24 hours A.S.T.M. D570—42	0.35–0.4%	0.15–0.6%	0.034–0.44%	0.2–0.4%	0.04–0.05%
Diffusion of water (diffusion constant D)	Deeg and Frosch ("Modern Plastics," Nov., '42) and A.S.T.M. D697—42 T	1.0	Deeg and Frosch ("Modern Plastics," Nov., '42) and A.S.T.M. D697—42 T	0.1	—	—	4.1	3.5
Dielectric strength	A.S.T.M. D149—44	Short time, 405 volts/mil. Kilovolts at puncture = 50.2 Step-by-step, 380 volts/mil. Kilovolts at puncture = 46.7	A.S.T.M. D149—40 T 44 44 T 45 1/8 in. v./mil. (= volts/0.025 mm.)	350–400 (Short time)	380–500 (Short time)	380 (Short time)	450–500 (Short time)	Greater than 400 (Short time)
Volume resistivity	A.S.T.M. D257—49 T	Greater than 2.3×10^{6} megohm/ins. Greater than 5.9×10^{14} ohm/cms.	A.S.T.M. D257—38 46	$1.0–7.0\times10^{12}$	—	Greater than 4×10^{14}	Greater than 10^{15}	$10^{17}–10^{19}$ (Type I)
Dielectric constant	A.S.T.M. D150—47 T	50 — 10^{6} — 3.10^{9} c.p.s. 22°C. . . 3.7 — 3.6 — 3.09 50°C. . . 3.9 — — — — 104°C. . . 4.15 — — — —	A.S.T.M. D150—42 T 44 T 46 T 47 T	60 — 10^{6} c.p.s. 6.5–7 5 — 4.0–5.5	60 — 10^{6} c.p.s. 3.0–4.36 — 2.8–3.7	60 — 10^{6} c.p.s. 3.45–5.0 — 3.6–4.5	60 — 10^{6} c.p.s. 3.5–4.5 — 2.7–3.2	1,000 — 10^{6} c.p.s. 2.5–2.7 — 2.5–2.7
Dissipation factor	A.S.T.M. D150—47 T	50 — 10^{6} — 3×10^{9} c.p.s. 25°C. . . 0.007 — 0.027 — 0.027 100°C. . . 0.005 — 0.027 — —	A.S.T.M. D150—42 T 44 T 46 T 47 T	60 — 10^{6} c.p.s. 0.1–0.15 — 0.04–0.05	60 — 10^{6} c.p.s. 0.003–0.028 — 0.009–0.026	60 — 10^{6} c.p.s. 0.006–0.019 — 0.028–0.06	60 — 10^{6} c.p.s. 0.05–0.06 — 0.02–0.03	1,000 10^{6} c.p.s. 50×10^{-5}
Arc resistance	A.S.T.M. D495—48 T	50–180 secs.	A.S.T.M. D495—48 T	—	124 secs.	121–126 secs.	—	—
Surface resistivity	A.S.T.M. D257—49 T	Greater than 3.8×10^{7} megohms	—	—	—	—	—	—

Values are taken from current technical literature.
Wherever possible and practicable all values calculated in metrical measures.
Standard test methods are given where known.
A.S.T.M. = American Society for Testing Materials.
VSM = Verband Schweiz. Maschinen-Industrieller.

(1) Mechanical and chemical grade, Type I. PMMA (technical data, May, 1948).
(2) Rigid quality. PMMA (technical data, May, 1948).
(3) Cast allyl. PMMA (technical data, May, 1948).
(4) Cast resin, heat resistant Type II (b). PMMA (technical data, May, 1948).
(5) Heat-resistant. PMMA (technical data, May, 1948).

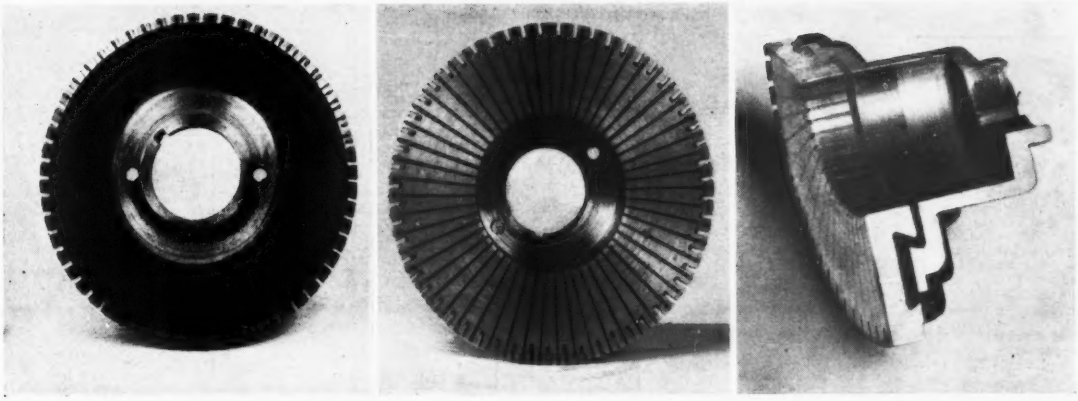


Fig. 4.—The copper segments of this commutator, which are separated by mica, are bonded to one another and to the body of the rotor by "Araldite" casting resin B.

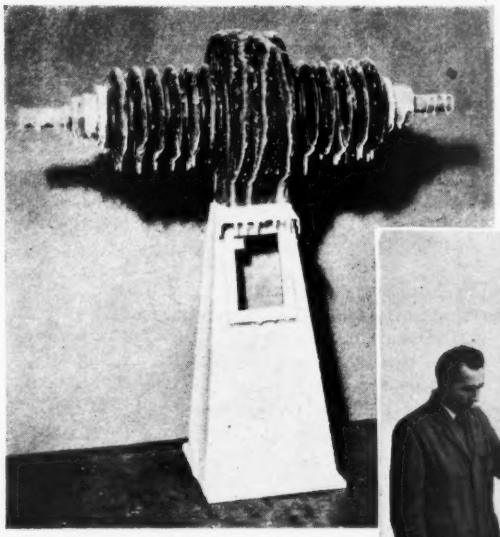


Fig. 5.—Current transformer, embedded in "Araldite" casting resin B, undergoing arctic tests. (Courtesy, Maschinenfabrik Oerlikon, Switzerland.)

Fig. 6 (below).—Part of current transformer completely embedded in "Araldite" casting resin B. (Courtesy, Maschinenfabrik Oerlikon, Switzerland.)

Fig. 7 (above).—Block of unfilled "Araldite" casting resin B (weighing 250 lb.) seen on the lathe. The cured resin is easily workable, and no cracks are visible.

Fig. 8.—The metal fitting of this insulator (fractured to show undamaged resin) is set into the porcelain body with "Araldite" casting resin B. (Courtesy, Maschinenfabrik Oerlikon, Switzerland.)

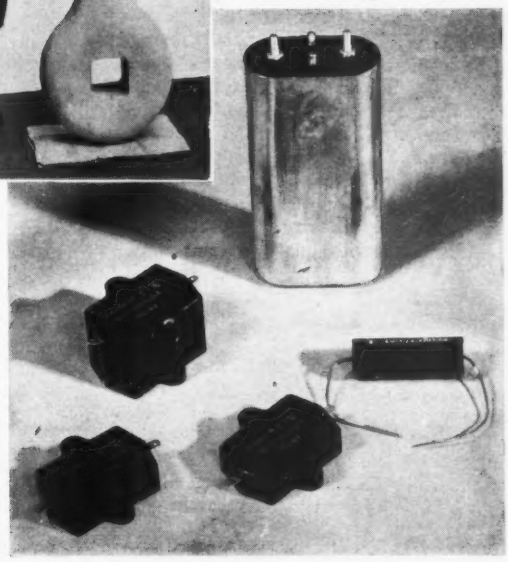


Fig. 9 (left).—The embedding and sealing of condensers by aid of "Araldite" casting resin B. (Courtesy, Fabrique de Condensateurs S.A., Fribourg.)

Table 2.—Influence of Fillers on "Araldite" Casting Resin B

"Araldite" casting resin B	100	100	100	100	100	100
Hardener 901	25-30	30	30	30	25-30	25-30
Filler	—	25 (Slate powder)	200 (Quartz or porcelain powder)	300 (Quartz-sand)	20 (Dibutyl-Dioctyl-phthalate)	10 (Tricresyl-phosphate) Santicizer 140
Specific gravity	1.1-1.2	1.25-1.35	1.7-1.8	1.9-2.0	1.2-1.25	1.2-1.25
Impact (cm.kg/sq.cm.)	20	3-7	6-7	1.5-3.5	13- >23	9-13
Flexural strength (kg/sq.cm.)	9-12	6.5-8.0	7-10	5-6	11-12	11-13
Tensile strength (kg/sq.mm.)	6-8	6.5-8.0	7.5-8.5	3.5-4	5-8	7-8
Modulus of elasticity (kg/sq.cm.)	25,000-35,000	45,000-55,000	120,000-140,000	150,000-180,000	35,000-40,000	40,000-45,000
Compression (kg/sq.mm.)	11-13	12-13	20-22	145-150	10-12	12-13
Hardness (Vickers) (kg/sq.mm.)	11-13	12-13	20-22	145-150	10-12	12-13
Shrinkage during curing (per cent.)	0.5-2.3	—	—	—	—	—
Heat distortion (Martens) (°C.)	110-120	110-120	120-125	125-130	60-75	. 70-80
Decomposition (°C.)	340-350	335-345	340-345	345-350	330-340	340-345
Flammability (sec.)	5-10	8-10	8-10	8-10	5-10	10 (exting.)
Ash contents (per cent.)	0.02-0.03	15-16	60-61	69-70	0.05-0.15	0.2-0.25
Coefficient of linear thermal expansion (mm/mm °C.)	60-65×10-6	60×10-6	30-35×10-6	25-30×10-6	80-90×10-6	65-70×10-6
Thermal conductivity (kcal/mh °C.)	0.17	—	ca. 0.54	ca. 0.73	—	—
Water absorption (60×10×4 mm.) (1 hr. 100°C.) ..	0.25-0.35	0.25-0.35	0.25-0.3	0.15-0.2	0.25-0.3	0.2-0.25
(24 hrs. 20°C.) ..	0.3-0.45	0.3-0.4	0.3-0.45	0.2-0.3	0.3-0.4	0.35-0.45
Shear strength of bonded aluminium test strips (kg/sq.mm.)	2.0-2.5	1.4-1.9	1.8-2.0	0.8-1.8	2.2-2.7	2.5-2.8
Dielectric strength (½") (volts/mil.)	Short time : 405 Step by step : 380	—	—	—	—	—
Dielectric strength (KV)	45/2 mm.	—	60/3 mm.	—	—	—
Dielectric constant (ε)	5×10 : 3.7 10³ : 3.7	—	5×10 : 5.9 10³ : 5.8	—	—	—
Dissipation factor (loss tan δ) (per cent.)	5×10 : 0.007 10³ : 0.007	—	5×10 : 1.2 10³ : 0.7	—	—	—

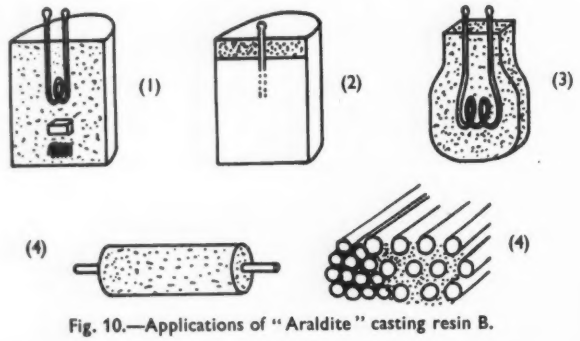


Fig. 10.—Applications of "Araldite" casting resin B.

say, therefore, that the dielectric losses are somewhat higher than in the case of polystyrene, but markedly lower than those of the phenolic resins. Dissipation factor and arc resistance are good.

To summarize these points we can say that "Araldite" casting resin B is a product with good mechanical and electrical properties, plus the additional advantages of excellent adhesion, very small shrinkage and simple application.

Table 2 shows the influence of fillers on casting resin. The primary purpose of fillers is to lower the cost of the product. The first question will therefore be: How are properties in any way affected? As will be seen from this table, in some cases certain properties are actually improved; for example, the linear thermal expansion is reduced to half by the addition of approximately 200 per cent. quartz powder, and the heat conductivity is improved three or four times. Reports show that the dielectric strength is barely altered, and that the shear strength of joints is affected relatively little. The porcelain parts of insulators are already being manufactured from "Araldite" casting resin B filled with quartz or porcelain powder.

Fig 10 shows the principal fields of application of the casting resin: (1) Potting, (2) sealing, (3) embedding, (4) potting, embedding-impregnating.

Fig. 11 shows various methods of bonding with "Araldite" adhesives. On the left is a simple surface joint which can, if necessary, be produced under pressure. When joining tubes, however, pressure cannot be applied; in this case "Araldite" resin is the ideal bonding agent. The bottom row shows a few typical applications of the resin; it will be seen that these are only possible for a product similar to a solder, as in gap filling.

The excellent properties of ethoxyline resins have also been

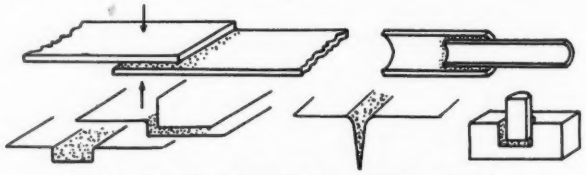


Fig. 11.—Examples of bonding by "Araldite" Type 1.

used in the field of surface protection. Here CIBA, Ltd., was able to develop its "Araldite" coating resins,[3] which gave outstanding performance as coatings for boxes, tins, or wires. At the same time, ethoxyline resins were also finding uses in the United States, as the so-called epoxide resins,[4] for coating purposes, and the good results obtained in Europe were confirmed.

REFERENCES.

(1) *Preiswerk and von Zeerleder, "Schweizer Archiv für angewandte Wissenschaft und Technik," Vol. 4, No. 12 (1946); Preiswerk and Meyerhans, "Electrical Manufacturing," July, 1949; Ros, "Sheet Metal Industries," Sept., 1949; Preiswerk, Meyerhans and Denz, "Materials & Methods," Oct., 1949; Preiswerk and Charlton, "Modern Plastics," Nov., 1950; Meyerhans, "Kunststoffe," Dec., 1951.* **(2)** *Preiswerk and von Zeerleder, "Plastics," July, 1946.* **(3)** *Ott, "Sheet Metal Industries," Feb., 1949.* **(4)** *Narracott, "Industrial Chemist," Sept., 1951.*

CORRECTIONS.—The following corrections apply to the first instalment of this article published in "Plastics," January, 1952:—

Page 10, left-hand column: Omit lines 21-27. (The subject matter of this paragraph appears in the present instalment, together with the illustration to which it refers.)

Page 10, left-hand column, line 28: For "Figs. 7-13" read "Figs. 7-12."

Page 10, right-hand column, line 12: For "Fig. 14" read "Fig. 9."

Census of Production, 1952

The Census of Production to be taken in 1953, in respect of the year 1952, is to be simplified. Forms will contain fewer questions than in any previous census and "sampling" will be introduced for the first time. The census will cover all producing industries as before and returns will be required from all firms over a certain size in each trade.

The statutory form of return will include questions on (1) working proprietors, (2) average employment during the year, (3) wages and salaries, (4) plant, machinery and vehicles, (5) new building work, (6) total materials and fuel purchased, (7) work given out, (8) stocks at the beginning and end of the year, (9) total output, and (10) transport payments.

Any firm requiring further particulars should write to the Census of Production Office, Neville House, Page Street, London, S.W.1.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Nylon

Sir,—In your editorial in the January, 1952, issue of "Plastics," we noticed the following reference to nylon moulding powder: "Nylon in moulding 'powder' form is neither in large production nor large in demand, as the use is not yet widespread, but one moulder complains that he has been forced to import from France."

As it stands, this statement gives the impression that moulders in this country are not particularly interested in nylon moulding powder. This is certainly not the case, as great interest is shown in this product and a considerable but unfortunately unsatisfied demand exists for it.

Nylon moulding powder is not yet in large-scale production, the bulk of the nylon polymer output being earmarked for dollar-earning applications. Of the comparatively small quantity of nylon moulding powder being manufactured by I.C.I., the Government have earmarked well over 50 per cent. for certain priority applications and what is left is only sufficient to satisfy a very small percentage of the potential commercial demand. We shall not be able to produce large quantities of nylon moulding powder until new plants are built, which may not be until 1954-55. This factor does not, however, prevent us from taking a very keen interest in this development and in commercial potentialities which we believe to be considerable.

It is worth mentioning that in our opinion the engineering uses for moulded nylon, such as bearings, gear wheels and similar components, will eventually be responsible for a substantial tonnage.

IMPERIAL CHEMICAL INDUSTRIES, LTD.
London.

[EDITOR'S NOTE: What we tried to infer was not that nylon was not one of the most promising of raw materials for the plastic industry, but that many moulders, knowing of the shortage and small production, were not anxious to suggest it to potential customers.]

Plastics Covers for Machines

SIR,—We shall be glad if you could let us know the names of manufacturers of machine covers in plastics material, similar to typewriter covers.

ENGINEERING DEVELOPMENTS (ENGLAND), LTD.
50, Pall Mall, London, S.W.1.

Acid-resistant Sealing Medium

Sir,—We have a problem of nickel and chromium plating a steel tube, approximately $\frac{3}{8}$-in. dia., which has been filled with a powder. We wish to keep this powder absolutely bone dry, as it is an electrical insulator. With this end in view we are trying to find some liquid plastic in which we can dip the end of the tube to form a seal which will keep the powder dry during the normal plating process. We had thought of using a substance similar to that employed for the sealing of stoppered bottles seen on the shelves of chemists' shops. We should be pleased to hear if you could name any supplier who handles such a material.

"ENQUIRER."

[EDITOR'S NOTE: While it would be quite simple to produce a plastic seal for the tube, the main point is to ensure that the plastic itself is not attacked by the strongly acid plating solution. The viscose (regenerated cellulose type) commonly used would almost certainly break down, and, generally speaking, fluxing agents used in the modern hot-dip process might prove a weak point. However, some hot-dip mixtures may contain softeners that are not attacked by strong acids. There is, further, the important problem of adhesion, and unless some preliminary primer is possible, there is the danger of plating solution creeping underneath the plastic covering.

It is possible that the best solution is to use an end plug. Presumably this should be made of polythene or vinyl co-polymer, both of which resist chromic acid at normal plating temperature. We suggest such a plug to be designed for the job, to sit perfectly on the rim of the tube and to be long enough to resist any increase of pressure within the tube. The outer portion would have to be shaped to permit perfect washing of the tube following plating. If the shape of the tube precludes the use of a plug, then the hot-melt dip process seems the only possibility.

Light-polarizing Plastics

SIR,—I should be interested to know if you have recently published any information or technical details concerning the manufacture, or the composition, of the "light-polarizing plastics." Can you give me the address of a manufacturer of synthetic organic pigments for producing these light-polarizing plastics?

DOTT. GIOVANNI TREVIS.
Via Zara 39,
Genova, Italy.

[EDITOR'S NOTE: We believe the only manufacturers of light-polarizing plastics sheet, in England, are Polarizers (United Kingdom), Ltd., 186, Acton Lane, Harlesden, London, N.W.10. The actual organic compound which polarizes the light is not a pigment, but a colourless crystalline powder; we believe it is a complex quinine-iodide compound. Possible manufacturers are: L. Light and Co., Wraysbury, Bucks; Hopkin and Williams, Ltd., Freshwater Road, Chadwell Heath, Essex; British Drug Houses, Ltd., Graham Street, London, N.1.]

Electrical Test Fixtures

Sir,—We require about 60 electrical test fixtures, each in the region of 4 in. cube and able to withstand 30 kV. Moulding would be rather expensive from the tooling point of view. We should therefore like to contact a firm able to undertake the casting of plastics. We understand that the casting process is practised by a few firms, and it would appear that this method would suit our requirements.

A.C.-SPHINX SPARK PLUG CO.
Dunstable.

[EDITOR'S NOTE: Cast phenolics, polymethyl methacrylate, or polyester resins should meet our correspondent's needs. The dielectric test for the above shows strengths of about 300 volts/mil in the case of phenolics, and 400-500 volts/mil in the case of the other two materials. The casting of phenolics is carried out by Catalin, Ltd., 54, Farm Hill Road, Waltham Abbey, Essex, and United Ebonite and Lorival, Ltd., Little Lever, near Bolton, Lancs. Polymethyl methacrylate is cast by T. Gerrard and Co., Ltd., 46-48, Pentonville Road, London, N.1; polyester resins, by E. M. Cromwell, Ltd., Galloway Road, Bishop's Stortford, Herts.]

Notebook Cover

SIR,—We wish to contact a plastics firm that would be prepared to manufacture a cover for a shorthand-typist's notebook to our requirements.

J. AND M. KERR.
14, Stainburn Avenue,
Leeds, 7.

Fluorescent Plastics

Sir,—We are anxious to locate a fluorescent plastic in sheet form, similar to the sample which we send. We understand that this is a cellulose material.

THE MODOPLAST CO.
60/2, Dharamtala Street,
Calcutta 13.

[EDITOR'S NOTE: The sample sent is certainly cellulose acetate. We suggest that you get in touch with M. and B. Plastics, 3, Wimpole Street, W.1, and also BX Plastics, Ltd., Higham Station Avenue, Chingford, E.4.]

Lay-Flat Tube

Sir,—Could you advise us where we might be able to obtain supplies of polythene tube; alternatively, moisture-proof "Cellophane" tube, or "Cellophane" or polythene bags, for use as a protective pack?

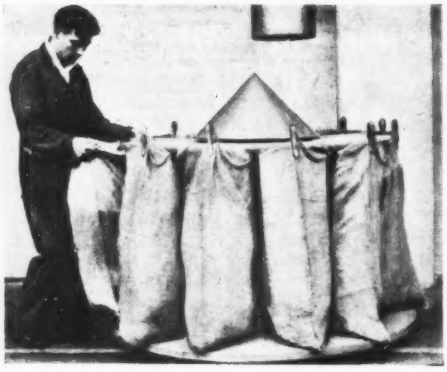
ALEXANDER ENGINEERING CO., LTD.
Haddenham, Bucks.

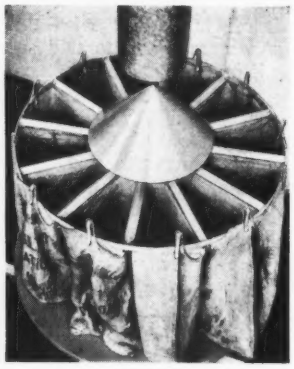
[EDITOR'S NOTE: Polythene lay-flat tube is supplied by Cascelloid, Ltd., Abbey Lane, Leicester; Thomas De La Rue and Co., Ltd., Plastics Division, 84/86, Regent

(*Continued on page 50*)

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes





Labour-saving equipment for sack filling.

MULTI-BAGGING ATTACHMENT.—Wherever wood waste, fine sawdust, or other granular materials are discharged from an outlet to be collected in sacks they may present a handling problem, especially if they build-up quickly at the outlet and necessitate the continuous presence of an operator to prevent this happening. To overcome such a problem Dallow Lambert and Co., Ltd., pneumatic dust control engineers, Spalding Street, Leicester, have produced equipment which requires the minimum of attention. This equipment comprises a steel cone mounted centrally on an iron framework, which is divided into twelve sections and supported on a circular metal fabricated base with castors. It is placed directly beneath the discharge outlet so that when material is discharged it is evenly distributed to each of the twelve sacks. By moving the equipment slightly to one side, some of the sacks which are almost filled can be removed and replaced by empty sacks without interrupting the flow of material. Simplicity of design, coupled with its efficiency, is the outstanding feature of this labour-saving device.

DIAMOND TOOLS AND ABRASIVES. The Industrial Diamond Information Bureau, 32-34, Holborn Viaduct, London, E.C.1, have sent us a copy of the new edition of the "Industrial Diamond Trade Names and Index, 1951-1952." This publication, compiled jointly by the Industrial Diamond Information Bureau and the "Industrial Diamond Review," lists approximately 1,500 trade names of manufacturers of diamond tools, hard abrasives, sintered carbides and materials for the precision engineer. Copies may be obtained from N. A. G. Press, Ltd., 226, Latymer Court, Hammersmith, W.6, price 3s. 6d.

THE GAUGE AND TOOL MAKERS' ASSOCIATION announce that their next quarterly luncheon will take place at the Savoy Hotel, London, on February 20, at 12.30 for 1 p.m., when the guest of honour and chief speaker will be the Rt. Hon. Duncan Sandys, Minister of Supply.

The Association also announce that they will have a large composite stand in the Engineering Section of the 1952 B.I.F. at Castle Bromwich, Birmingham (May 5-16), featuring members' manufactures of gauges and measuring equipment, jigs and fixtures, special-purpose machines, press tools, engineers' small tools, moulds and dies, and diamond tools. This composite stand will include an information bureau, with supplies of the Association's publications and members' sales literature. It is also intended to display the prizewinning entries in next year's Competition in Craftsmanship and Draughtsmanship which the Association is arranging to coincide with the 1952 Fair.

BRITISH PLASTICS FEDERATION announces the following staff changes:—Dr. W. E. de B. Diamond becomes Director and secretary; Mr. C. J. G. Stanley to be manager; Mr. B. C. Aldis and Mr. R. C. Penfold, to be assistants to the Director.

ACHEMA X—This exhibition meeting for chemical engineering will take place in Frankfurt/Main, May 18 to 25, 1952, when a European meeting of engineering chemistry will also be arranged. At the same time the Société de Chimie Industrielle, Paris, will hold its 25th International Congress for Industrial Chemistry. In conjunction with Achema X, the Dechema and the Committee for Chemical Engineering of the Association of German Engineers (VDI) will hold their annual meetings. Further particulars relating to Achema X may be obtained from Dechema Deutsche Gesellschaft für chemisches Apparatewesen E.V., Frankfurt/Main 13, P.O. Box 1337.

RADIO HEATERS, LTD., Eastheath Avenue, Wokingham, Berks, inform us that their new London offices are at 46, Gray's Inn Road, W.C.1.

POLYESTER RESIN reinforced with glass fibres is being used to replace aluminium and bronze (in short supply) in small totally enclosed fan-cooled A.C. motors by Westinghouse, in the U.S.A. The glass fibre reinforcement has been found superior to organic fibre because of its higher resistance to chemical attack and greater strength. ("Product Engineering," December, 1951.)

BRITISH INDUSTRIAL PLASTICS, LTD., reports a group profit of £557,451 for the year to September 30, 1951, an increase of £163,212 on the previous year's figure of £394,239. After depreciation, taxation and other charges the net profit is £159,957, against £111,201.

MOULDERS' PLANT CAPACITY.—The British Plastics Federation have given us permission to publish the following summary of moulders' plant capacity for 1949, 1950 and 1951, based on information collected annually by the Moulders' Group:—

	1949	1950	1951
NUMBER OF MOULDERS—			
Compression	114	100	102
Injection	74	69	78
COMPRESSION MOULDING CAPACITY—			
Total number of presses	3,791	3,568	3,535
Total capacity of presses (tons)	298,609	290,273	292,195
NUMBER OF PRESSES (according to capacity)			
Up to 25 tons	1,143	1,042	1,010
26 to 50 tons	863	779	843
51 to 100 tons	1,219	1,192	1,136
101 to 150 tons	280	264	251
151 to 200 tons	106	94	87
201 to 250 tons	55	68	76
251 to 300 tons	13	18	18
301 to 350 tons	46	48	48
351 to 400 tons	11	8	8
401 to 450 tons	2	3	3
451 to 500 tons	16	16	17
501 to 1,000 tons	27	22	24
1,001 to 1,500 tons	7	11	11
1,501 to 2,000 tons	3	3	3
INJECTION MOULDING CAPACITY—			
Total number of presses	586	589	743
Total capacity of presses (oz.)	1,977	2,148	3,039
NUMBER OF PRESSES (according to capacity)			
Up to ½ oz.	93	76	66
½ to 1 oz.	90	87	105
1 to 2 oz.	100	105	125
2 to 3 oz.	62	75	120
3 to 4 oz.	86	80	113
4 to 5 oz.	6	6	12
5 to 6 oz.	48	40	39
6 to 7 oz.	3	2	8
7 to 8 oz.	82	103	109
8 to 20 oz.	12	12	34
20 to 32 oz.	3	2	7
32 to 40 oz.	1	1	1
40 to 50 oz.	—	—	3
50 to 75 oz.	—	—	1

The total number of moulders in the group is now 118.

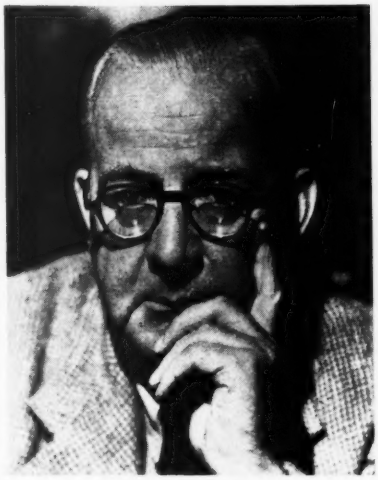
Private Account Imports of Moulding Powders. (Board of Trade—Plastics Materials Section.)

	Licences Issued Sept. 1951	Arrivals Sept. 1951	Licences Issued Oct. 1951	Arrivals Oct. 1951
	tons	tons	tons	tons
Cellulose acetate butyrate (U.S.A.)	0.55	14.85	9.8	30.1
Polystyrene (U.S.A.)	—	—	72.25	25.45
Phenol and cresol formaldehyde (U.S.A.)	2.65	—	0.9	—
Polystyrene (Canada)	72.3	118.55	158.45	152.55
Phenolic (Canada)	—	—	3	—
Cellulose acetate butyrate (Germany)	—	—	—	—
Phenol and cresol formaldehyde (Germany)	—	37.1	—	99.9
Polystyrene (Germany)	—	15	—	—
Cellulose acetate (France)	—	0.05	—	—
Phenol and cresol formaldehyde (France)	—	70.85	—	—
Totals	75.5	256.4	244.4	308

E. K. COLE, LTD., announce that Mr. David Radford and Mr. Walter M. York, among other executives, have been appointed directors of the company. Mr. Radford joined E. K. Cole, Ltd., in 1943 as works manager of the Southend radio factory and was appointed general manager of the Ekco Plastics Division in 1945. This section of the company's interests has greatly expanded under Mr. Radford's control. Mr. York, F.I.A.M.A., M.I.S.M.A., has been responsible for Ekco publicity since joining the company in 1932. He is chairman of the British Plastics Federation Publicity Committee.

Mr. Walter M. York (left) and Mr. David Radford (right) have recently been appointed directors of E. K. Cole, Ltd.

MR. J. V. CROSSLEY, M.Sc., assistant regional manager of the Scotland and Northern Ireland Region of I.C.I., has been appointed a director of the Plastics Division, with responsibility for sales. Mr. Crossley graduated from Leeds University in 1922. He joined the Dyestuffs Department of I.C.I. in Glasgow in 1940, and in 1942 was appointed plastics sales manager, Scottish Division, later becoming regional sales manager, Plastics Department, Scotland and Northern Ireland Region.



Mr. J. V. Crossley.

BRITISH MOULDED PLASTICS, LTD., recently held their first Annual Sales Convention, when executives dealing with sales, development and design, from both London and Birmingham, had opportunity to discuss their work. This occasion was of considerable importance to both British Moulded Plastics, Ltd., and Moulded Products, Ltd. With Mr. H. P. Bridge in the chair, the meeting reviewed the past year and made plans for the future. Amongst other things made known at the Convention were the following recent changes in Sales Administration: Commercial manager, Mr. M. J. Nash; sales managers, Mr. F. R. A. Grimstone (Government Contracts Division), Mr. P. D. Allan (Bituminous Division), Mr. J. Bridge (Radio Division), Mr. R. G. L. Welham (Extrusions Division), Mr. O. Collett (Northern Counties and North Wales Area), Mr. H. D. Rattenbury (Western Counties and South Wales Area), Mr. R. Hudson (Scotland and Northern Ireland), Mr. W. J. Fluckiger (Motorcar Division and assisting sales in Birmingham). In Birmingham the administration is: Mr. A. E. Curtis (sales manager), Mr. H. H. Callaghan (Textile Section), Mr. R. Gledhill (Leicestershire, Northants, Oxfordshire and Bedfordshire areas), and Mr. C. Sherwood (Staffordshire, Worcestershire and Warwickshire areas). Mr. G. A. James is manager of the Group's Export Division.

British Moulded Plastics, Ltd., Annual Sales Convention.

BIRKBYS, LTD., have appointed Mr. A. C. Clarke as assistant to their London manager. He will act as technical representative in the area covered by the company's London office, 79, Baker Street, W.1. (Telephone: Welbeck 3746.)

MICANITE AND INSULATORS CO., LTD.—Mr. H. A. Cooper, F.C.I.S., and Sir Geoffrey L. Winterbotham have been appointed directors of the company. Mr. Cooper is general manager of the company and Sir Geoffrey L. Winterbotham is a director of the parent company, Associated Insulation Products, Ltd., as well as managing director of F. F. Chrestien and Co., Ltd. The Board also announce that the title of Mr. J. M. Fleming, M.A., B.Sc. (Tech.), M.I.E.E., is changed from chief development engineer to director of research.

TELEGRAPH CONSTRUCTION AND MAINTENANCE CO., LTD.—Mr. Peter E. M. Sharp, A.C.G.I., B.Sc. (Eng.), A.M.I.E.E., has now joined the company's Commercial Department and is specializing in communications cables and systems. Mr. Sharp was previously with the Council of Industrial Design, where he was responsible for the selection and organization of Communications and Electronic exhibits at the Festival of Britain.

MONSANTO CHEMICALS, LTD., announces that, due to his business obligations in the U.S.A., Mr. Edgar Monsanto Queeny has regretfully found it necessary to resign from the Board.

Mr. L. A. Lewinton, who has for some time acted as alternate director for Mr. Queeny on the Board of Monsanto Chemicals, Ltd., has been appointed a director.

MR. JAMES A. RAFFERTY, vice-president and director of Union Carbide and Carbon Corp., and president of Bakelite Corp., died at Fort Lauderdale, Fla., U.S.A., on December 19. He was elected president of Bakelite Corp. in 1939 and became chairman of the Board in 1944.

DURHAM CHEMICALS, LTD., have issued useful specifications in leaflet form of stabilizers for p.v.c. The notes include the fundamental requirements for such stabilizers, the methods of testing their efficacy and a table assessing their comparative value so far as heat stability, light stability and transparency are concerned. This analysis makes reference to some twenty metallic soaps and salts that have been suggested as stabilizers. In addition to the production of the pure stabilizers, Durham Chemicals, Ltd., produce them in paste form ready-mixed with plasticizer for the convenience of customers who wish to avoid the use of dry powders.

MOULDERS' PRODUCTIVITY TEAM. A team chosen by the Moulders' Group of the British Plastics Federation is visiting America under the auspices of the Anglo-American Council on Productivity. The team was due to sail on February 12, and will leave New York for home on March 30. A number of moulding works and moulding machinery makers will be visited; also the exhibition and convention organized by the Society of Plastics Industry Inc., at Philadelphia, March 11 and 12. The team is constituted as follows:—

SUPERVISORY GROUP:

Mr. L. Honey, foreman, Hoover, Ltd., Greenford.

Mr. F. A. Howlett, manager (tool room), British Xylonite Co., Ltd., Cascelloid Division, Leicester.

Mr. E. L. Merritt, director and general manager, Evered and Co., Ltd., Smethwick.

Mr. J. S. Walker, technical director, Fraser and Glass, Ltd., London.

Mr. J. H. P. White, works manager, Cosmocord, Ltd., Enfield.

TECHNICIANS GROUP:

Mr. H. Beaumont, production engineer, Derwent Plastics, Ltd., Stamford Bridge, Yorks.

Mr. D. Eccles, technical supervisor, E.V.B. Plastics, Ltd., Salfords, Surrey.

Mr. A. Prasser, works and development manager, Plastic Engineers, Ltd., Pontypridd.

Mr. E. H. Sharp, development manager, British Xylonite Co., Ltd., Halex Division, London.

Mr. A. L. Sparshott, head of development section, Witton Moulded Insulation Works, Birmingham.

WORKSHOP GROUP:

Mr. J. Barker, press operator, British Xylonite Co., Ltd., Halex Division, London.

Mr. W. C. Fish, chargehand in press shop, Ashdowns, Ltd., St. Helens.

Mr. R. Norwood, press operator, Fraser and Glass, Ltd., London.

Mr. E. Patching, plastics moulder, Hoover, Ltd., Greenford.

Mr. J. R. Tegerdine, polisher, E. K. Cole, Ltd., Southend.

RESERVE:

Mr. A. Taylor, works manager, Evered and Co., Ltd., Smethwick.

The team secretary is Mr. C. J. G. Stanley, manager, British Plastics Federation. The team leader is Mr. A. L. Sparshott, whose name already appears above.

FORTHCOMING MEETINGS

Feb. 14.—"Recent Developments in Plasticizers with reference to p.v.c. and its copolymers." Plastics Institute, Scottish Section, and Oil and Colour Chemists Association, Scottish Section, St. Enoch Hotel, Glasgow.

Feb. 15.—"Trends in Phenolic Resin Applications," D. N. Buttrey, Plastics Institute, Midlands Section, James Watt Memorial Institute, Great Charles Street, Birmingham, 6.30 p.m.

Feb. 21.—"Extrusion of Plastics," C. E. Ceney, Institution of Engineering Inspection. Compton Grange, Wolverhampton, at 7.30 p.m.

Feb. 22.—"Compounding and Calendering," P. I. Wilson, Plastics Institute, Midlands Section, Bell Hotel, Leicester, 6.45 p.m.

Feb. 27.—"Paper Making," C. A. Chester, Plastics Institute, North-Eastern Section, Miners' Institute, Newcastle, 7 p.m.

Feb. 29.—Plastics Institute Leap Year Day Dance, London Section. Victoria Hall (North Suite), Bloomsbury, W.C.1, 8 p.m.

Mar. 3.—"The Nature of Plastics," D. Mahon. Royal Institute of Chemistry, Woolwich Polytechnic, London, S.E.18, 6.45 p.m.

Mar. 6.—"Synthetic Polymers in Textile Finishing," J. G. Evans and G. Landells, Plastics Institute, London Section, Waldorf Hotel, Aldwych, W.C.2.

Mar. 7.—Symposium on "The Mechanical Properties of Plastics." Society of Chemical Industry, Plastics and Polymer Group, Institution of Electrical Engineers, Savoy Place, W.C.2, at 10 a.m. Introductory Remarks by Dr. N. J. L. Megson; "Physical Evaluation of Small Samples of Plastics," K. H. C. Bessant, C. E. Hollis and J. J. Millane; "The Interpretation of Mechanical Tests on Plastics," C. G. Evans and H. W. Hall; "Some Mechanical Properties of Perspex," Dr. E. A. W. Hoff, "An Extrusion Plastometer for Thermoplastic Materials," R. Hayes; "Indentation Testing of Phenolic Mouldings by Brinell and Hot Needle Methods," C. E. Avenell and J. H. Bennitt.

Mar. 7.—"Cosmic Balloons," H. Heitler, Plastics Institute, Western Section, Erinoid Sports and Social Club House, Lightpill, Stroud, 6.30 p.m.

Mar. 12.—Yorkshire Section Members' Night. "Plastics in Brake Linings," C. G. Addingley; "Day to Day Problems of a Moulder," J. Thwaites; "Hydraulic Presses," W. H. Thrippleton. Plastics Institute, St. Mark's House, 186, Woodhouse Lane, Leeds, 2.

Mar. 12.—"The Use of Plastics in Floor Coverings," L. H. Griffiths, Plastics Institute, Southern Section. Polygon Hotel, Southampton, 7.30 p.m.

Mar. 12.—Film Meeting, Plastics Institute, Scottish Section, Institute of Engineers and Shipbuilders in Scotland, Glasgow, C.2, at 7.30 p.m.

Mar. 13.—Film Meeting, Plastics Institute, Western Section, Park Hotel, Cardiff, 7 p.m.

LETTERS TO THE EDITOR

(*Continued from page 47.*)

Street, W.1; and by I.C.I., Ltd., Plastics Division, Welwyn Garden City, Herts. Polythene bags are also made by Oppenheimer Casing Co. (U.K.), Ltd., Rival Packaging Division, 159-165, Harrow Road, London, W.4; Porosan, Ltd., 4-5, Warwick Court, High Holborn, London, W.C.1.; and E. S. and A. Robinson, Ltd., 1, Redcliff Street, Bristol. "Cellophane" tubing is made by British Cellophane, Ltd., Bath Road, Bridgwater, Somerset. Tubing and bags made from cellulose acetate might also meet your requirements, enquiry regarding these should be made to British Celanese, Ltd., Hanover Square, W.1; Utilex, Ltd., Mill Street, Kingston-on-Thames, Surrey, and Courtaulds, Ltd., Foleshill Road, Coventry.]

Export Inquiry

Sir,—We would appreciate receiving the names and addresses of makers of plastics cigarette boxes and tobacco jars, and plastics materials for window display.

G. DAMMAN AND CO. PTY., LTD.
C/R Collins and Swanston Streets,
Melbourne, Australia.

Transparent Egg-shaped Containers

Sir,—I shall be greatly obliged for the name of a manufacturer of containers of Easter-egg shape, in transparent plastics material, size about 5 ins. by 4 ins.

A. E. WARREN.
2, Nathan Street,
Bolton Road, Bradford.

[EDITOR'S NOTE: Transparent egg-shaped containers for Easter gifts are supplied by Cascelloid, Ltd., Abbey Lane, Leicester; Kingcraft, Ltd., Mill Street, Kingston-on-Thames, Surrey; Chiltern Paper Products, Hemel Hempstead, Herts.]

Liquid Soap Dispenser

Sir,—We are requiring supplies of a liquid soap dispenser, made in plastics material. This dispenser is of the type which delivers a certain measure of liquid on pushing a button or pulling a lever.

GASKELL AND CHAMBERS, LTD.
Coleshill Street,
Birmingham 4.

Knitting Needle Material

SIR,—We shall be glad to have the names and addresses of manufacturers of plastic rods and knobs as used for knitting needles. We require these for another purpose, and in large quantities.

THE CORBY STRETCHER-PRESS.
Frances Road,
Windsor.

Beads

Sir,—We are urgently needing a quantity of plastics beads about 1-in. to 1½-in. diameter.

MODERN ART MANUFACTURERS.
439, Hessle Road,
Hull.

[EDITOR'S NOTE: The following, among others, are manufacturers of plastics beads: N. L. Bennett, Bath Street, Belgrave Road, Leicester; Scintillex, Ltd., 34, Purewell, Christchurch, Hants.]

Snap Fasteners

J.N. wishes to contact manufacturers of acetate snap fasteners for vinyl raincoats.

Machines for the Industry

Watson-Stillman 300-oz. Injection Machine

In publishing the following description of the largest injection machine in the world (its advent first mentioned in our September, 1950 issue, p. 253) we beg to acknowledge the co-operation of the Watson-Stillman Co., Roselle, New Jersey, U.S.A., and their distributing agents in this country, Omni (London) Ltd., London, W.C.2, especially for original photographs enabling us to re-create the exploded drawing included here.

BY adding a preplasticizing cylinder to an 85-oz. horizontal injection moulding machine, the Watson-Stillman Co. of Roselle, New Jersey, U.S.A., have increased the moulding capacity of their latest machine to 300 ozs. of acetate per shot. The function of the preplasticizer is to take plastics material from the hopper in relatively small amounts, heat it uniformly, and pack it into the main injection chamber, where it is stored, at proper moulding temperature, until there is sufficient quantity to make a shot.

To accommodate different sizes of dies, the injection ram pressure is adjustable up to 2,850 lb./sq. in., and die clamping pressures up to 3,000 lb./sq. in. can be maintained. Since the main clamping ram is the single-acting type, twin auxiliary cylinders (21) are provided for the fast advance and return speeds of the clamping ram (12), with slow-down periods provided during the actual die opening and closing. The travel of the plasticizing, injection and clamping rams is controlled by the main oil pump (19); a smaller pump (20) maintains pressure on the clamping ram during the entire holding period.

To accommodate the needs of a specific job, the operator can select either manual or single-cycle automatic operation, and adjust the speed of the injection ram, the injection and clamping pressures, and the temperature of each of the heating elements in the preplasticizing and injection cylinders.

The cycle starts when the safety door is closed, permitting the clamping unit to move forward with a rapid advance and a slow-down prior to die contact. When proper clamping pressure is reached, the main shooting plunger (8) injects the plasticized material into the die cavity. The quantity of material supplied to the main shooting cylinder (7) is predetermined by a setting on an adjustable control rod. When the shooting cylinder is filled, the plasticizing plunger (3) returns to its rear position, allowing additional material to flow into the heating chamber (5) from the hopper (1). A shut-off device between the plasticizing cylinder (2) and the shooting cylinder (7) then comes into operation and closes to prevent material from being forced back into the plasticizer during the injection stroke. This entire recharging of the shooting cylinder is done during the curing part of the cycle. Finally, the clamping unit returns, stripping the moulding to complete the cycle.

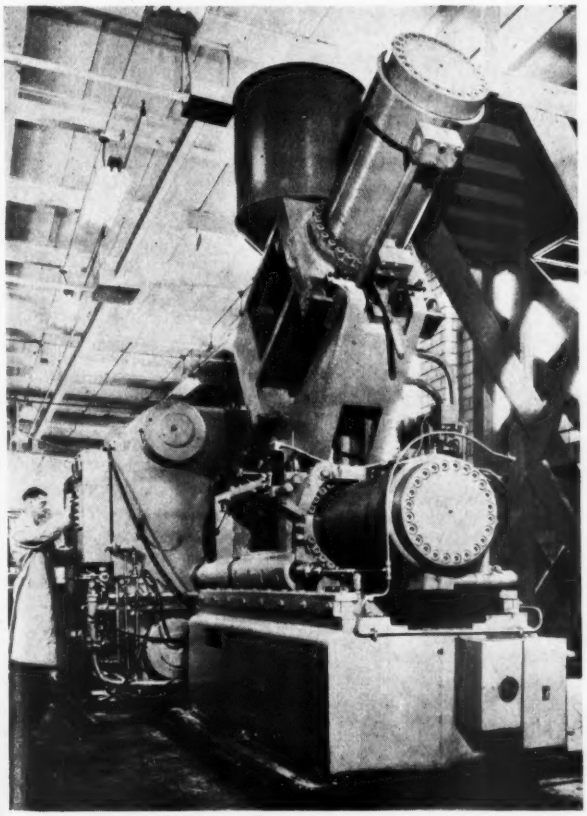


Fig. 1.—The Watson-Stillman 300-oz. injection machine in operation: view from preplasticizer end.

Pumping Units and Hydraulic Controls

The main pump (19) is an Oilgear radial piston type operating at high pressure, the auxiliary pump being a rotary vane type operating at low pressure.

The high pressure pump incorporates an unloading control which reduces the pump stroke to a point just sufficient to maintain the pre-set pressure continuously by automatic follow-up, but without excessive heating or power loss. This pump also incorporates stepless volume control that is effective only during that part of the injection plunger stroke when the mould is filling. The shooting speed of the plunger is adjustable in a stepless range down to 10 per cent. of maximum. Regardless of the pump volume setting, all other ram movements of clamping and plasticizing units are at maximum speed. The pressure control is located outside, and is on the control panel as is the volume control.

A special Oilgear pump unit (20) is included for holding, and delivers to the clamping circuit only. This results in maintaining a continuous pressure on the main ram, assuring positive mould clamping at all times.

The pumping unit consists of a reservoir tank, 300 gallons capacity, which forms the base for motors and starters. The pumping unit is complete with circulating pump (17), oil cooler (15), oil strainer, air breather, and various valves and piping.

An accurate and sensitive control of clamping ram travel for die setting is obtained by means of the inching control hand-wheel, located on the front of the machine, which provides a stepless variation of hydraulic power from zero to maximum.

The injection cylinder is securely mounted and held in alignment by two tapered wedges to the cylinder bracket, designed for quick and easy removal from the machine. All internal surfaces in contact with the plastic material are highly finished and chromium-plated. The cylinder is equipped with Calrod heating units and Wheelco two-zone heat controls.

The preplasticizing cylinder is also securely mounted and held in alignment by two tapered wedges to the cylinder bracket, and designed for quick and easy removal from the machine. It is fitted with a fully streamlined torpedo, and all internal surfaces in contact with plastic

1.—Hopper. 2.—Plasticizing injection cylinder. 3.—Plasticizing injection plunger. 4.—Torpedo. 5.—Heating cylinder. 6.—Auxiliary injection unit shifting cylinders. 7.—Main shooting cylinder. 8.—Main shooting plunger. 9.—Injection platen. 10.—Stripper bar. 11.—Door safety control. 12.—Clamping ram. 13.—Clamping cylinder. 14.—Prefill valve. 15.—Oil cooler. 16.—Main pumps motor. 17.—Oil circulating pump. 18.—Double end motor. 19.—Main pump. 20.—Holding pump. 21.—Advance and return cylinders. 22.—Adjustable guides.

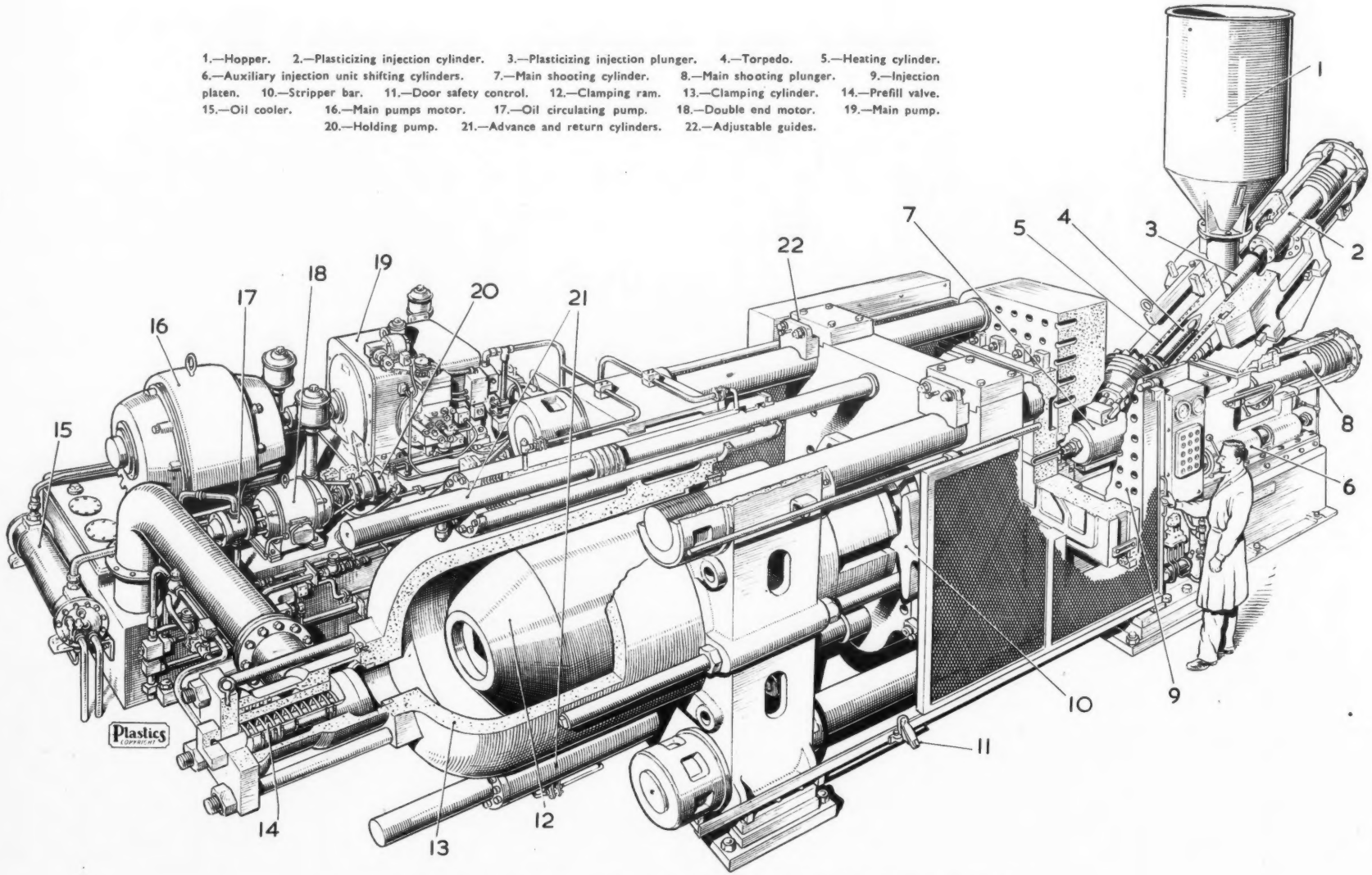


Fig. 2.—Watson-Stillman 300-oz. injection moulding machine (showing pre-plasticizing unit on right).

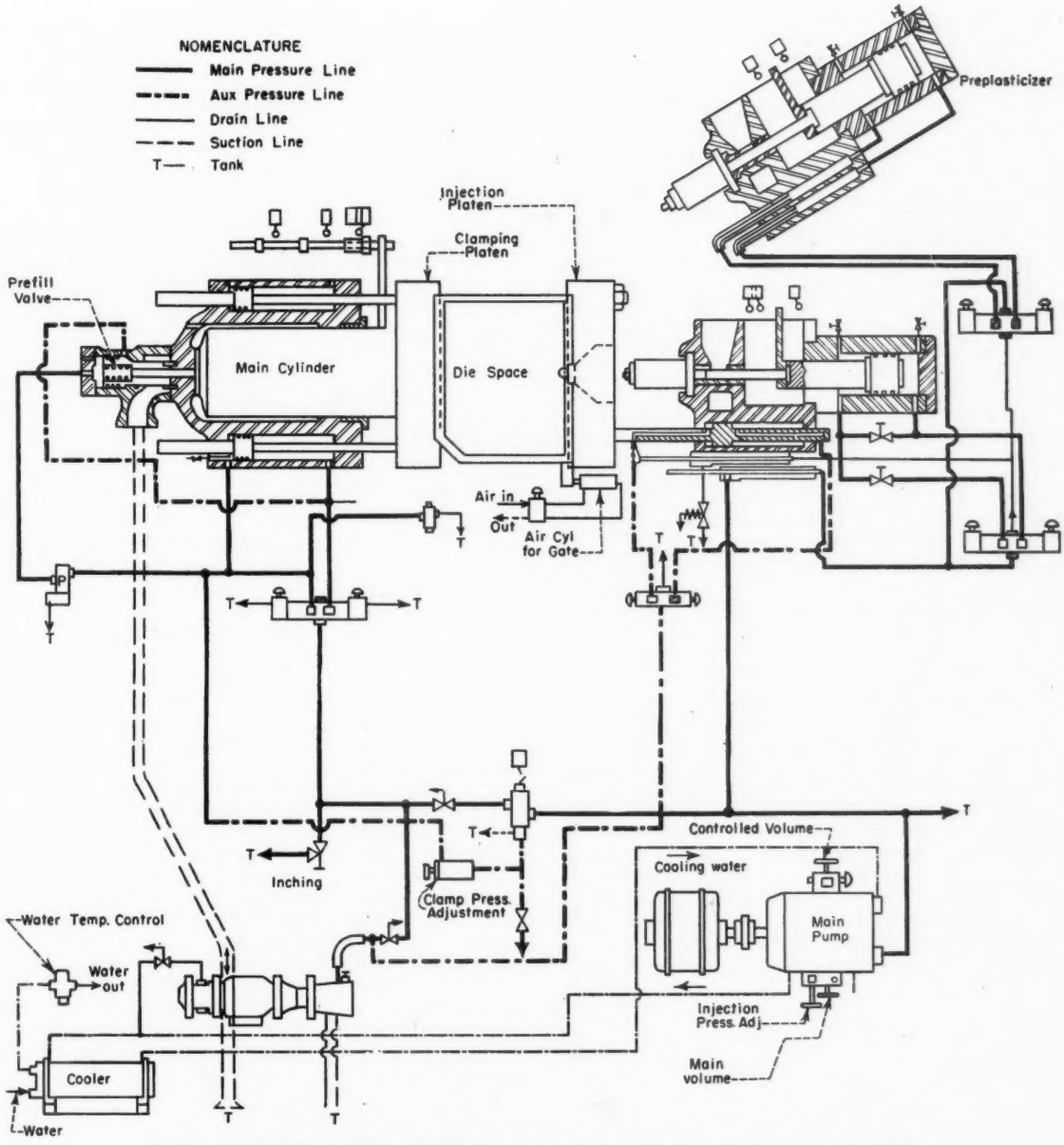


Fig. 3.—Watson-Stillman 300 oz. injection machine : diagram showing main features and pipe lines.

material are highly finished and chromium-plated. It is also equipped with Calrod heating units, arranged for three-zone control.

The electric feed control for material is self-compensating and assures accurate controlled feed which can be instantly adjusted. A stainless-steel hopper (1) of proper design is provided, mounted above the injection bracket and having a capacity of 500 lb. of material.

Automatic Nozzle Seal

The entire injection unit can be moved to and from contact with the die by means of a hydraulic cylinder for a total distance of 24 ins. The injection unit is mounted on ways, provided with gib guides and tapered guide shoes for both vertical and lateral adjustment of the entire unit. The actuating cylinder also provides constant force, holding nozzle against contact bushing to provide automatic nozzle seal. A movement of 1 in. beyond the face of the stationary die platen is provided to accommodate variations in position of contact bushing in the die.

When the actuating cylinder is in extreme stroke position, a large convenience opening is available for clean-out, nozzle attention, or cylinder removal. A dual switch makes it necessary for the operator to use both hands when cold shooting, and gives complete protection to the operator.

Clamping Unit

The straight hydraulic clamp assures positive clamping pressure and consists of a single-acting steel cylinder (13) in which the main ram operates. The main ram (12) is ground and polished, and operates through the long bronze guide bushings fitted in the main cylinder throat.

The packing is external under the gland and is of the Chevron type. Since the main clamping ram is the single-acting type, twin auxiliary cylinders (21) are provided for the fast advance and return speeds of the clamping ram, with slow-down provided. This position is predetermined by the adjustment provided by a limit switch and cam arrange-

ment. At this predetermined position, the oil under pressure is diverted to the large ram area, effecting slow-down in the ram travel. A separate holding pump maintains pressure on the ram during the entire holding period, and assures positive mould clamping. The circuit is such that the moulds part at slow speed and again slow down before contacting the knock-out mechanism. Slow-downs are adjustable to suit different moulds, thereby increasing mould life and providing for smooth operation.

The stroke of the clamping platen is adjustable to suit the requirements of the mould and moulded part, thus making it possible to operate the machine at reduced stroke and shortening the overall cycle for shallow parts.

Platens

The movable die platen is a steel forging with smooth tooled finish, fitted with precision tapered bronze shoes for guiding on columns, which are adjustable against wear. The platen is arranged with three knock-out bars and is provided with 5 pin holes along the length. Knock-outs are adjustable, so that they are effective at stroke position of the clamp platen, and they are designed to limit the knock-out stroke to a predetermined length up to 6 ins. After the setting is made, it is impossible to damage the moulds by exceeding the stroke of the stripper or clamp platen. A 12-in. spacer is provided between the clamp ramp and the movable die plate, which can be readily removed to accommodate deeper dies.

The stationary die platen is of steel with smooth tooled finish and has a centrally-bored hole for die alignment. Mould platen faces are provided with a standard pattern of tapped holes for mould mounting.

The four steel tie rods are 10-in. diameter and are accurately machined to ensure perfect mould alignment.

Controls

All motors and controls are wired ready for operation; they have only to be connected to a source of power. The motors are supplied for 220 or 440 volt, 3-phase, 60-cycle A.C. current. The heating and control circuits operate on 220-volt, single-phase, 60-cycle current.

The main control valves are of the packless, piston type, pilot pressure operated, solenoid controlled. Pilot pressure is supplied by the main pump, and is used for actuation of the 4-way valves and the pilot operator on the main pump for shifting to reduce delivery.

Push-buttons are furnished for start and stop of the motors. The closing and opening of clamp and injection stroke is controlled by hand switches, which operate the main operating valve. With manual operation, it is possible to operate the clamp and injection units independently.

The machine may be operated as a single-cycle automatic; selection for either single-cycle or manual operation is made at the small selector switch on the control panel. A large safety door, with control (11), on the front side of the machine serves to start the cycle on single-cycle automatic operation. There is a removable safety screen at the rear of the machine. An air cylinder is provided to automatically kick the front safety door and start opening it at the completion of the moulding cycle. A large palm button, mounted conveniently for the operator, serves to interrupt the electrical control and stop the motors in cases of emergency.

Three Wheelco electronic proportioning instruments are provided, mounted in a panel for zone control of the cylinders. This panel is incorporated in the control cabinet, which also houses the electrical controls. Individual motor-driven timer units control the cycle when operating on automatic single-cycle control. A selection of manual or automatic single-cycle operation is possible by aid of a selector switch.

The control cabinet is designed for floor mounting at any desired location; a safety disconnect switch is incorporated, and a mechanical interlock makes it impossible to open the cabinet unless the switch is in "off" position.

General Data

The maximum injection capacity of this machine is 300 oz. per shot. The capacity of the plasticizing cylinder is 85 oz. per stroke, or 300 lb. per hour. Die closing is effected at a speed of 550 ins. per minute for fast closing, minimum slow closing speed being 17 ins. per minute. Slow break of the clamping pressure is 35 ins. per minute, followed by fast opening at 525 ins. per minute.

The injection plunger is 5 ins. diameter; injection cylinder diameter (21,000 lb./sq. in. on plunger), 13½ ins.; injection cylinder ram diameter (9,250 lb./sq. in. on plunger), 9 ins.; injection cylinder stroke, 21 ins.; maximum pressure (adjustable), 2,850 lb./sq. in. Forward and return injection speeds are 115 and 210 ins. per minute respectively.

The plasticizing plunger diameter is 5 ins.; plasticizing cylinder diameter, 13½ ins.; plasticizing cylinder stroke, 17 ins.; plasticizing cylinder pressure, 2,850 lb./sq. in. Clamp cylinder pressure is 3,000 lb./sq. in.; clamp cylinder force, 1,500 tons; clamp cylinder stroke, 48 ins. Stripping capacity is 98 tons.

Daylight opening is 72 ins. (with spacer, 60 ins.). Maximum die thickness is 24 ins. (with spacer, 12 ins.). The maximum size of die which can be accommodated is 72 ins. wide by 48 ins. high.

Rated maximum power consumption for heating is 50 kW; total motor h.p. 90. The floor space occupied by the machine is 6 ft. 6 ins. by 31 ft.; that occupied by the pumping unit is 5 ft. 3 ins. by 11 ft.

Works "Safety" Colour Code

DURING recent years industry has given increasing attention to the colour coding of danger points in factories, to indicate high voltage lines, toxic gases, and obstructions such as low doorways and steps and other varying degrees of hazard. In view of this, a Committee of the British Standards Institution, representative of a wide variety of experience, has been considering the possibility of preparing a "safety" colour code in order to secure unification of the present different practices.

The Royal Society for the Prevention of Accidents made an extensive inquiry on behalf of the Committee, as a result of which and of other investigations, it has now been decided to abandon the attempt to prepare a code.

Examination of the problem showed that a distinction must be made between a "safety" colour code and an "identification" colour code, the purpose of the former being to classify types of hazard and to give warning of them by colour, whilst the object of the identification code, as in British Standard 1710 for pipe lines and British Standard 349 for gas cylinders, is primarily to identify by colour the contents, any application to safety being incidental.

It was the former type of code that the Committee had to consider, and it was found that many colours had traditional connotations, which, whilst not always consistent, were so well known that they could not be reconciled.

The second difficulty was that the only truly satisfactory method of ensuring safety is to eliminate the hazard, and the Committee felt that a code might encourage identification of hazards by colour instead of their removal.

Thirdly, the increase in the scientific use of colours for decoration to secure better light and to improve working conditions detracted from the effectiveness of a safety colour code, and these schemes of colour treatment were considered to be more effective in the reduction of accidents.

Evidence submitted also showed that the significance of colour codes put into effect had been quickly forgotten. Whilst this is relatively unimportant in the case of identification where time is not vital, it was felt to militate seriously against the use of a safety code where recognition and significance of colour must be not only immediate but also instinctive.

Successful Designing for Plastics Moulding—XIX

By W. M. HALLIDAY

In this instalment the author deals with some of the errors commonly made in design where sleeve inserts and pin mountings are concerned.

GENERALLY, hollow sleeve inserts will have to be mounted upon special support pins located in the mould. These pins, in turn, will have to be very accurately positioned in the mould housing, as well as being closely fitting on the critical bored hole of the sleeve. Such pins serve to position the insert correctly and to hold it in the proper moulding position. Support pins performing these important functions must therefore be machined with close precision and should be as strong as possible so that maximum resistance will be offered to the heavy flowing pressures and drag concentrated on the insert.

A number of errors in respect of ultimate location of the sleeve insert may therefore occur, and the following brief account of some of the more common faults arising with inserts and support pins will be found helpful by indicating several undesirable features to be avoided when designing and machining moulds, etc., for use with inserts.

(i) OVERSIZE INTERNAL BORE.—Where a sleeve insert has a threaded bore into which a plain support pin has to engage, it will sometimes be difficult to control the uniformity of core diameter on the hole to ensure each successive insert sleeve will be a close fit on the pin.

Common drilling and tapping tools employed to form the threaded bore in the insert may sometimes produce oversize holes, and since the mould support pin will have to register therein, slackness may occur with some insert pieces. The effects of this are seen at A (Fig. 1), which shows a simple cylindrical sleeve insert moulded into the wall of a component.

With this example it should be specially noted that the length of the insert is exactly the same as the thickness of the wall section, resulting in both ends of the metallic insert bearing against the respective top and bottom mould faces as shown.

With an insert mounting of this character, slackness occurring between the threaded hole and the support pin as depicted to an exaggerated degree in the diagram, the only direction in which the sleeve insert may be displaced will be in the lateral plane. Thus the sleeve may be moulded with its centre axis off-set to that of the support pin. This would incur the risk of excessive variation in the centre distances of the insert bushing and other critical holes or location points on the moulding.

In cases where the sleeve insert does not have to extend fully through the wall of the moulding, and thus will only have one end in engagement with the mould force, as shown at B, slackness between hole and support pin may cause additional error to that of lateral misplacement.

The insert sleeve may be tilted from the true perpendicular relative to the critical sealing face of the mould force, and thus the threaded hole would be moulded in a misaligned relationship to the force after the fashion illustrated. This condition would render it difficult to engage the threads of the fixing screw or other fastening article. If too forcible a locking pressure were to be employed when admitting that screw, the walls of the moulding might easily be cracked, or even torn asunder completely at some closely adjacent point, because of the excessive side pressures entailed by the attempts of the insert sleeve to right itself square with the mould force face. The latter condition would be particularly prone to arise if the fastening screw, etc., were to be of very long length.

(ii) INSERT SLEEVES OF INSUFFICIENT LENGTH.—If a short sleeve insert has to be moulded into a wall having the plastics material covering all its external surfaces, endfaces as well as periphery, after the manner shown at C (Fig. 1), or when the threaded hole is very shallow in depth, certain objections may arise, particularly if the insert is in brass or copper and is required to give conductance of electric current through the wall.

This latter feature would be impaired due to the presence of flashings formed over one or both endfaces. Moreover, such flash would tend to pass down the threads for a certain depth, which, being connected to the main collar flash at the ends, would incur additional difficulties when ejecting the support pin, or the moulding therefrom. This would arise because of the excessive binding action

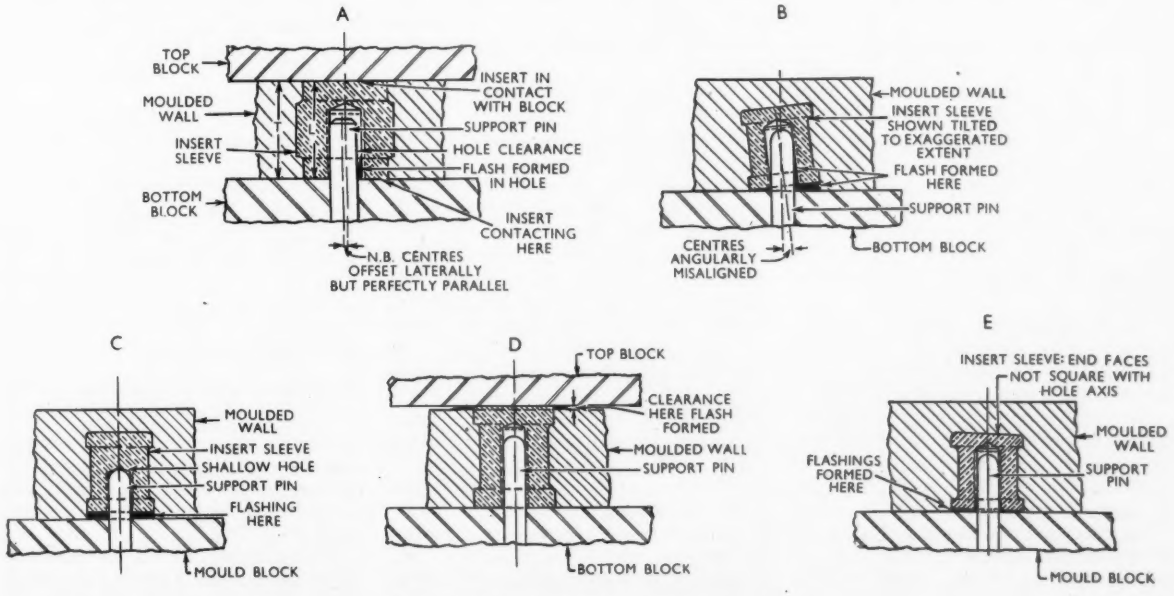


Fig. 1.—Faults occurring with sleeve inserts.

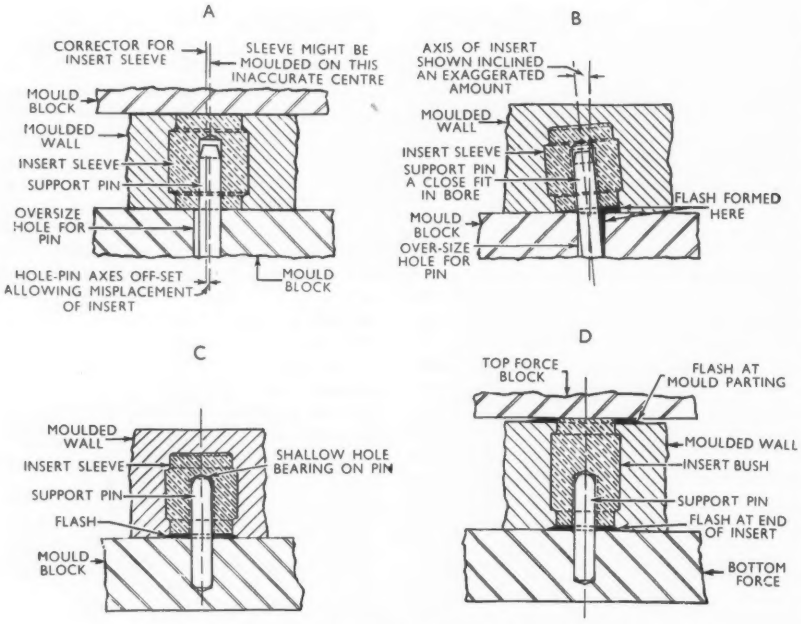


Fig. 2.—Faults occurring with support pin mountings.

occurring between the flash and the sides of the pin.

Some difficulties would also be encountered when removing flashings from the finished moulded article, and a re-tapping operation may be involved to clear the threads. Where the hole depth in the insert is relatively small the support pin, or the critical faces of the mould forces, may be severely damaged as a result of the insert being pushed too high above the bottom force. This condition would result in the insert being trapped between top force and support pin.

(iii) INSERT SLEEVES OF EXCESSIVE LENGTH.—Correct mould closure may be impeded and additional thick flash formed along their parting-line joint surfaces if the sleeve insert is over length after the manner shown at D. This same undesirable feature may also result in damage being inflicted to the critical mould sealing surfaces due to the heavy closing pressures normally imparted to the forces. The metallic insert sleeve might also suffer damage by distortion due to the high squeezing pressures imposed thereon when the mould is closed.

(iv) INACCURATELY FORMED INSERT SLEEVES.—The diagram E (Fig. 1) shows the unsatisfactory moulding features occurring as a result of inaccuracies in the forming of the insert. With this example the endfaces of the sleeve are not machined perfectly square with the longitudinal axis of the threaded hole up the centre of the sleeve.

This condition would cause thick flash to be moulded across one side of the exposed endface of the insert, and in cases where such error was great, the flash would be liable to pass along the sides of the support pin and into the threads. The speedy and simple ejection of the finished moulding from the support pin would thereby be impaired, whilst flash remaining within the threads would cause difficulties during deflashing and assembly operation.

Faults Occurring with Support Pin Mountings

Diagrams A to D (Fig. 2) illustrate certain troublesome errors and faults commonly liable to occur in respect of support pin location. These faults, etc., would generally be transmitted to the insert, affecting its location, or alignment with the critical mould block sealing faces.

(i) OVERSIZE LOCATING HOLE IN THE MOULD.—Example A (Fig. 2) depicts how serious lateral displacement of the sleeve insert may be occasioned by slackness between the shank of the support pin and the mounting hole provided in the mould block.

With this example, the insert sleeve would be maintained perpendicular with the sealing faces of the two opposed mould blocks by reason of its contact with those faces, but the slackness in the mounting hole would allow the pin to move sideways, resulting in some degree of off-setting of the centre distance between sleeve and other critical locating points in the moulded article.

(ii) MISALIGNED SLEEVE RESULTING FROM SLACKNESS IN PIN MOUNTING.—Diagram B (Fig. 2) shows how the entire sleeve insert may be moulded in a misaligned relationship, substantially out of the perpendicular, as a result of an undue amount of slackness existing between the shank of the support pin and the guide hole formed in the mould block

With this example, unlike the preceding one at A, the length of the sleeve insert is very much less than the thickness of the moulded wall, and one endface only of the member has to be moulded exactly in line with the sealing joint surfaces of the mould. Thus, the mould blocks, in contact with only one endface of the bushing insert, cannot hold that item in the true position as with the previous case, and therefore any slackness present between support pin and its guide hole would allow the insert to tilt over in the manner indicated.

The undesirable effects, i.e., flashing along endface and threads, and misalignment of hole axis, etc., have already been noted in connection with certain previous examples above.

(iii) OVER-LONG SUPPORT PIN OR TOO-SHALLOW GUIDE HOLE.—Diagram C (Fig. 2) indicates the faults liable to arise when the locating hole in the mould block is too shallow in depth or when the support pin is over length. With this example it will be noted that the insert bushing is very much shorter than the thickness of the moulded wall, thus it will make contact with the sealing surfaces of the mould only at one end.

If the guide hole is too shallow or the pin excessively long, the insert may be lifted well above the jointing surface of the lower mould block, resulting in the formation of thick flash across the endface of the sleeve, and possibly such flash would pass down the threaded hole for a certain distance.

Diagram D (Fig. 2) shows how similar heavy flashing may be caused at both ends of the bush insert when the length of the latter is identical with the wall thickness of the article, and when misplacement of the insert relative to the forces is caused by a too-long support pin or a shallow locating hole in the bottom force.

The effect of this condition would be to lift the insert sleeves above the floor surface of the cavity formation in the bottom block, and to prevent the top force from closing properly along the parting joint. The condition would invariably be accompanied by some damage inflicted on insert, or support pin, or both, due to the heavy compression pressures imposed on the mould blocks during closure.

Other Design Considerations with Sleeve Inserts

Viewed from the mould designer's angle, four important factors will usually have to be considered in reference to the application of any sleeve insert: (1) The ability to machine the insert economically; (2) the provision of strict dimensional accuracy on the sleeve insert; (3) selection of shape and form

which will ensure easy, simple and rapid mounting of the insert sleeve into the mould locations; (4) the design of the insert to obtain most effective resistance to moulding pressures—due to tool closure—and the frictional drag of the flowing plastics material, to give maximum freedom from cracking and/or serious distortion of the surrounding moulded plastics walls; or the deformation of the hollow insert sleeve.

The last condition will be prone to arise in those cases where the insert sleeve has a particularly thin wall section between outside diameter and hole. To prevent deformation of such an insert, special precautions will be necessary when designing the part and selecting its proportions. This question of the ability of the insert sleeve to withstand moulding and flowing pressures will naturally include the critical support pin on which the insert has to be mounted. The same pressures will be imposed on this latter element, which must be designed accordingly.

The earlier discussions in recent articles in this series have chiefly dealt with the essential design requirements of sleeve inserts; the problems arising with their correct location and retention in the mould and wall of the article; the errors or faults liable to occur in the finished moulding; and the preferred ways and means for overcoming the latter, all of which arise in respect of the first three factors just mentioned above.

Designing Insert Sleeves for Effective Pressure Resistance

It now remains to make some brief mention of the similar considerations to be dealt with in relation to the designing of inserts, and location facilities in the mould, which will best satisfy the requirements stipulated in the fourth factor as given above.

With compression-moulded components in particular, heavy and quite often very complex forces and pressures will be imposed on the metallic sleeve insert and support pin. These forces will normally accrue from the closing movements of the mould forces, conducted under high pressure, which will be directly transmitted to the powder charge contained in the mould cavity. The resultant complex flowing action of the material will react upon the insert sleeve and its support pin mounting.

The magnitude of these pressures and frictional forces will often be of considerable importance; they may have to be determined during the designing stage, so that appropriate sizes and strength proportions may be ascertained for both insert and support pin. In estimating such pressure values the most important feature will be the extent of the surface area of the insert sleeve coming into intimate contact with the flowing plastics charge. This will be derived by the simple formula $3.14 \times D \times L$, where D is the outside diameter of the sleeve and L is its overall length.

The ratio between this projected surface area on the exterior of the sleeve, and the cross-sectional area of the threaded hole in the member will be equally important, and will be obtained by the formula

$$3.14 \times D \times L : \frac{d^2 \times 3.14}{4}$$

where " d " is the diameter of the hole.

A useful empirical rule for this ratio is

$$3.1416 \times D \times L : \frac{d^2 \times 3.14}{4} \text{ equals } 7:1$$

(maximum). This means that the projected external surface area of the sleeve should not exceed seven times the core-diameter cross-sectional area of the support pin employed with the sleeve. This proportion will generally give quite satisfactory results and ensure a support pin of sufficient strength to withstand the pressures acting upon the insert of that proportional size.

The ratio between diameter D and the length L of the insert sleeve (external dimensions) will be equally important, and a useful guiding rule for designing same should be L equals 1.25 to 1.35 times the outside diameter D. Alternatively, the outside diameter of the insert sleeve should not exceed about two and half times the core diameter of the threaded hole contained therein. The overall length of the sleeve may also be made approximately three times the core diameter of the threaded hole.

Thus, for most practical purposes, the external diameter of an insert sleeve should be kept as small as practicable, with its length correctly proportioned according to the above rules.

In those cases where a threaded support pin has to be employed for screwing into the insert sleeve, the length of the latter will be important. It will be essential to allow a certain length of thread engagement between these two members to ensure effective resistance to moulding pressures, etc. The length of such threaded engagement should, for most general purposes, be not less than 0.85 of the core diameter of the hole. A proportion of 0.90 to 1.0 of length to core diameter will usually be found most desirable as giving adequate safety margin.

With such threaded type support pins, the fine pitch threads should be used for preference, as these will ensure the maximum wall thickness of material between crests of threads and outside diameter of the sleeve.

(To be continued)

British Plastics Federation - Bowen Prize Fund, 1951

AS previously announced, the conditions for awards from the Bowen Prize Fund in 1951 were modified to attract more entries for the competition. It was decided by the Council of the British Plastics Federation that prizes should be awarded for a paper or papers read before the Plastics Institute or its branches, the Plastics and Polymer Group of the Society of Chemical Industry, including the Symposium or the Convention held in connection with the British Plastics Exhibition in June, 1951, or submitted direct by an author.

These modified conditions produced very good results, 22 papers being submitted for the prize. These were adjudicated with very great care and out of a short list three papers were considered for the award of prizes.

The total amount of the prizes was up to £150. The Council therefore decided to award a first prize of £100 jointly to R. J. W. Reynolds and J. R. Lewis, of the Dyestuffs Division of Imperial Chemical Industries, Ltd., for a very fine paper on " N-Substitution in Polyamides." A second prize of £30 went to G. M. Burnett, of the Chemistry Department, Birmingham University, for a paper on " Copolymerization "—an original contribution of considerable merit. A third prize of £20 was awarded to R. B. Richards, of the Alkali Division, Research Department, Imperial Chemical Industries, Ltd., for a paper on " Polyethylene—Structure, Crystallinity and Properties."

The adjudicators had considerable trouble in placing the papers in order of merit as there were some seven or eight entries which were extremely well written and important contributions to the science of plastics. They were just the type of paper which the founder of the Prize Fund, the late Mr. W. Bowen, appears to have had in mind.

To encourage entries in 1953, the Council has decided to offer prizes for original contributions on engineering and/or physical problems relating to compression, transfer and injection moulding. In making this decision the Council has taken into account the encouraging field which exists for research and investigation relating to the type of plant, general engineering and physical problems associated with the moulding processes.

It was also considered that if there are to be serious attempts to tackle some of the existing problems, suitable time must be provided, and a period of 18 months has therefore been decided upon for submission of entries. Accordingly, the awards will be made in 1953 and all entries must be submitted to the General Manager, British Plastics Federation, 47-48, Piccadilly, London, W.1, by July 31, 1953.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2s. 6d. each.

B.P. 656,510. Appl. 30.1.48. Conv. (U.S.A.) 4.1.47. Acc. 22.8.51.
Plasticized polyvinyl compositions. H. R. Gamrath, J. K. Craver. To: Monsanto Chemical Co.

Compositions of polyvinyl resins and certain monoalkyl diaryl phosphate esters are obtained to which a single plasticizer will impart low temperature flexibility, low volatility and non-inflammability.

B.P. 656,541. Appl. 2.7.47. Acc. 29.8.51.
Composite structures and method of making same. E. W. Rollinson. Comm. from: United Aircraft Corp.

Aluminium is bonded to a core (balsa wood; cellular cellulose acetate) by two adhesive layers, one a polymerizable adhesive, the second one of a thermosetting synthetic resin type.

B.P. 656,553. Appl. 25.11.47. Conv. (U.S.A.) 8.11.43. Acc. 29.8.51.
Methods of impregnating coils for electrical apparatus. To: The Brit. Thomson-Houston Co., Ltd.

The impregnant is an unsaturated alkyl resin or a polymerizable ester of a monohydric alcohol or a mixture of both. It is polymerized in the shell around the turns to a final infusible state.

B.P. 656,514. Appl. 23.3.48. Conv. (U.S.A.) 9.7.47. Acc. 29.8.51.
Moulds and method of making same. R. S. Riley. To: Firestone Tire and Rubber Co.

The mould comprises a body of polymerizable thermosetting resin reinforced with glass fibres.

B.P. 656,579. Appl. 14.4.49. Acc. 29.8.51.
Stoppers for bottles, jars and the like. G. W. Goodburn. To: Goodburn Eng. Co., Ltd.

The stopper is made from polythene and has a recess on top to be more deformable.

B.P. 656,643. Appl. 8.8.47. Conv. (U.S.A.) 24.5.39. Acc. 29.8.51.
Modifying the properties of polymeric organic substances with polyisocyanates and polyisothiocyanates. To: I.C.I., Ltd.

B.P. 656,725. Appl. 6.2.48. Conv. (U.S.A.) 18.2.47. Acc. 29.8.51.
Apparatus for moulding plastic materials to elongated shapes. L. L. Stott, E. E. Montross. To: The Polymer Corp.

Rods of diameters less than 1¼ ins. (especially of nylon) are made under axial pressure in a tubular mould held under tension to avoid transverse flexure. Plastics materials of different colours may be intermixed for mottled effects.

B.P. 656,728. Appl. 27.2.48. Conv. (U.S.A.) 6.12.41. Acc. 29.8.51.
Sizing or coating yarns, fabrics, films, and other structures composed of synthetic linear fibre-forming polymers. To: I.C.I., Ltd.

B.P. 656,735. Appl. 3.5.48. Acc. 29.8.51.
Method of making plastic tubes and films. A. Abbey. Comm. from: Dow Chemical Co.

The continuous extruded tube of fused normally crystalline vinylidene chloride polymer passes downwardly into a cooling bath of 0 to 20 degrees C., is thereafter warmed to higher temperature (20 to 50 degrees C.), inflated and stretched.

B.P. 656,783. Appl. 8.1.48. Acc. 5.9.51.
Manufacture of hollow articles formed from thermosetting or thermoplastic materials. C. Lomas. To: Ashdowns, Ltd.

A spinning pot for the artificial silk industry, reinforced by a jacket of glass cloth impregnated with a phenolic resin, is moulded in the jacket disposed in a die cavity between inner and outer mould members. The heated material flows axially under pressure into the cavity and is then set under final pressure.

B.P. 656,784. Appl. 28.1.48. Acc. 5.9.51.
Manufacture of moulded boards, flat sheets and other shaped articles. B. R. Dishon.

Comminuted ligno-cellulosic material (wood, cotton, etc.) is made self-bonding under pressure and heat by mixture with certain acids. Ammonium salts with formaldehyde or paraformaldehyde are mentioned. Phenol plastics may be added.

B.P. 656,820. Appl. 4.1.49. Acc. 5.9.51.
Boxes or box-like containers. J. F. Roos, J. Tramer. To: Tramer, Ltd.

The closure top has a plastic layer embossed and printed and extending beyond the edge of the reinforcing inner layer of cardboard.

B.P. 656,842. Appl. 9.10.47. Conv. (U.S.A.) 19.10.46. Acc. 5.9.51.
Resin-surfaced laminated materials. To: Bakelite Corp.

An assembly of resin-bonded fibrous sheets have a layer of a heat-hardenable resinous polyester, heat-hardened in situ on the sheets by heat and pressure. The surface layer may have a design incorporated.

B.P. 656,851. Appl. 25.2.48. Acc. 5.9.51.
Stethoscope. R. G. Poole. To: R. G. Poole, Ltd.

The cup-like body of the instrument enclosing an electric vibration pick-up device may be made of synthetic resin.

B.P. 656,862. Appl. 2.11.48. Acc. 5.9.51.
Manufacture of polymers. F. Brown. To: Dunlop Rubber Co., Ltd.

The polymerization of the monomeric material (methacrylic acid ester; styrene; vinyl carboxylic acid ester) is carried out in two stages, first in presence of a catalyst to form a stable dispersion, then flowing the stable dispersion through a tubular reaction zone maintained at polymerization temperature.

B.P. 656,961. Appl. 18.1.49. Conv. (Netherlands) 21.1.48. Acc. 5.9.51.
Moulding machines. To: N. V. Philips' Gloeilampenfabrieken.

The machine for moulding synthetic resins is provided with a safety screen whose movements control the operative period of the machine in connection with a timing device actuated on moving the screen into closed position.

B.P. 656,991. Appl. 25.1.49. Acc. 5.9.51.
Stoppers for flasks, containers and the like. S. H. Elliott. To: H. J. Elliott, Ltd.

The stopper is made from polythene. It is provided with spaced groups of peripheral ribs contacting the neck and forming airlocks between them to prevent creep of liquid by capillary attraction.

B.P. 657,080. Appl. 11.1.49. Acc. 12.9.51.
Plain bearings or the like. W. H. Tait, Glacier Metal Co., Ltd.

Polytetrafluoroethylene is incorporated in a metallic mixture, e.g., of a soft metal (silver) to be sintered below 400 degrees C. (See also B.P. 657,085.)

B.P. 657,081. Appl. 14.1.49. Conv. (U.S.A.) 7.9.48. Acc. 12.9.51.
Polymeric polyamines. To: E. I. Du Pont de Nemours and Co.

The salts are useful in imparting water repellence, shrink proofness, as pigment binders, soluble dye-stuffs for colouring plastics, etc.

B.P. 657,114. Appl. 24.6.28. Conv. (U.S.A.) 28.6.47. Acc. 12.9.51.
Packing structure. To: Pennsylvania Salt Mfg. Co.

The primary sealing material is a plastic solid polymeric tetrafluorethylene, the secondary a certain metal to seal a space against escape of fluorine or fluorine-containing fluid.

B.P. 657,125. Appl. 9.9.48. Acc. 12.9.51.
Machine for wrapping and packaging articles. K. D. Morgenstern, Ideal Packagings, Ltd.

The machine is intended for wrapping irregular shaped articles (oranges) into a sheet of thermoplastic material.

B.P. 657,154. Appl. 19.1.49. Acc. 12.9.51.
Windows for pressurized chambers. D. J. Hardy, Saunders-Roe, Ltd.

An inner domed ("Perspex") panel and an outer ("Perspex") panel flush with the outer skin of the aircraft form safe portlights at altitude.

B.P. 657,186. Appl. 9.2.49. Conv. (France) 8.4.48. Acc. 12.9.51.
Manufacture of table-tennis balls. J. Donier.

Special welding of the two moulded halves is followed by grinding and calibrating.

B.P. 657,196. Appl. 28.1.49. Acc. 12.9.51.
Ash-trays for smokers. H. A. Holt.

Safety ash tray of metal, "Bakelite" or other plastics, glass, ceramics, etc.

B.P. 657,212. Appl. 10.2.49. Conv. (France) 23.12.48. Acc. 12.9.51.
Preparation of solutions of polyvinyl chloride. To: Soc. Rhodiaceta.

Solvent mixture of acetone (not more than 70 per cent. by volume) and perchlorethylene (at least 30 per cent.).

B.P. 657,253. Appl. 18.1.49. Conv. (Sweden) 21.1.48. Acc. 12.9.51.
Method of manufacturing soft rollers for printing purposes of polyvinyl chloride gelatinized to rubber-like condition. To: Ulysunda Gummifabriks AB.

B.P. 657,338. Appl. 2.12.48. Acc. 19.9.51.
Production of hard cellular materials. A. K. Unsworth, B. R. Dann. To: Expanded Rubber Co., Ltd.

A hard expanded polyvinyl plastic is obtained by heating a paste of the polymer and a plasticizer solvent of certain properties forming a gel and gas bubbles. The gel is submitted to high pressure nitrogen or carbon dioxide, moulded, cooled and hardened, finally warm pressed into a flat board.

B.P. 657,516. Appl. 5.11.48. Acc. 19.9.51.
Containers with captive lids or closures. M. Biddulph, Universal Metal Products, Ltd.

Container and closure may be moulded in one piece from synthetic plastic.

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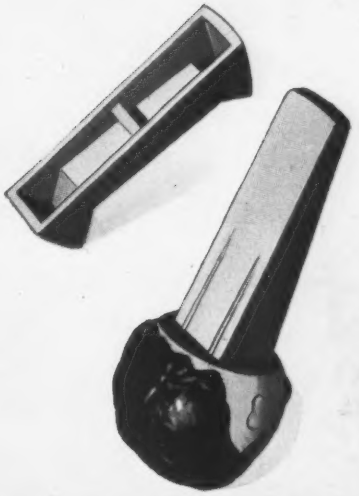

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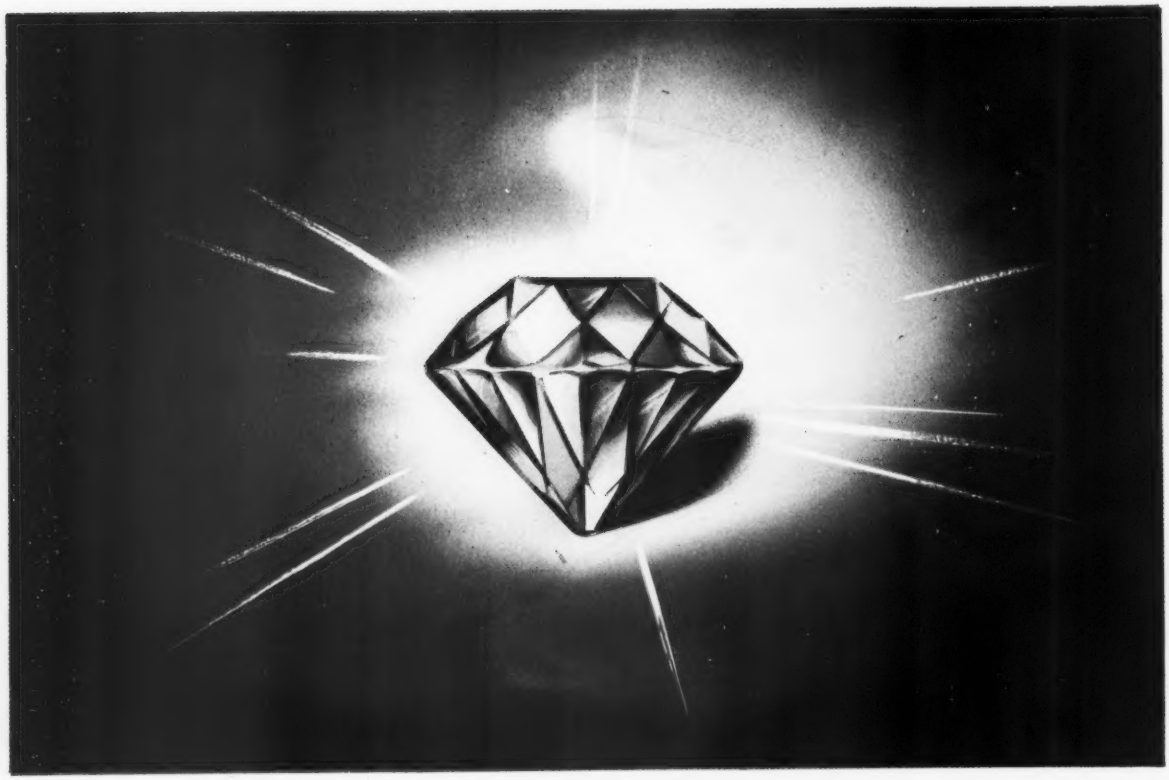

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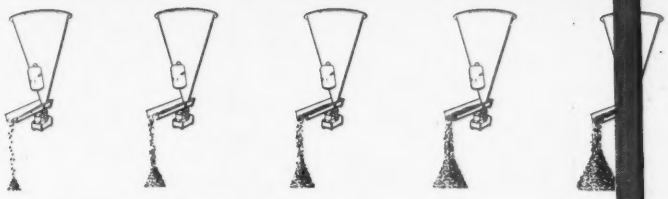

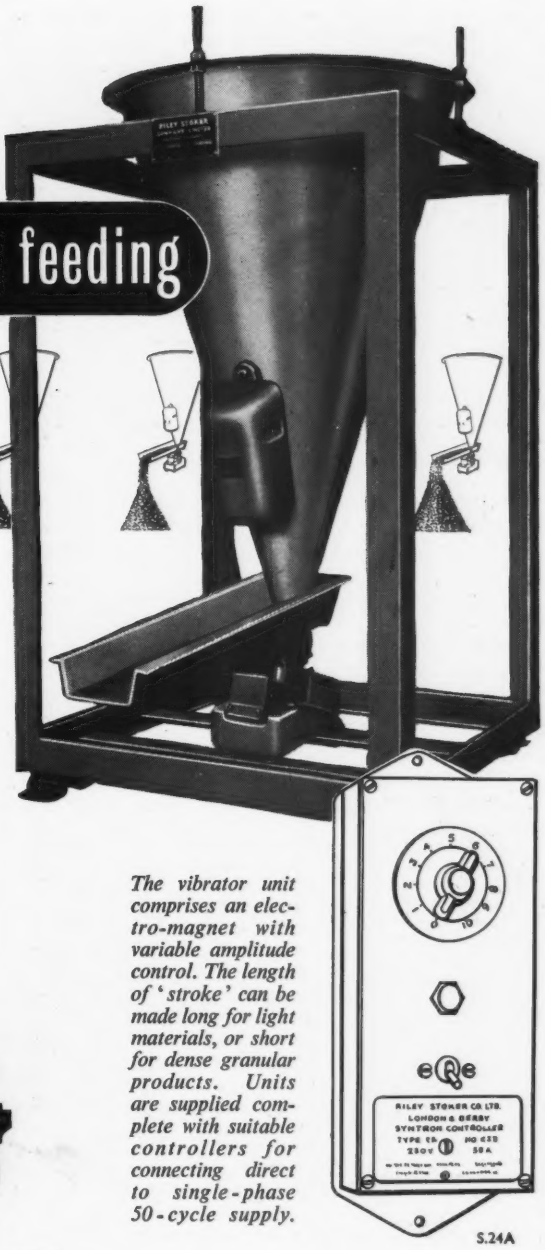

The Syntron Feeder Machine is a complete equipment, in which separate rheostat controls on vibrator and conveyor give an almost infinite flexibility at the touch of a knob. The noiseless vibrator fitted to the hopper prevents arching or bridging of the material, while adjustment of the height, angle and feed rate of the trough ensures continuous delivery at just the rate the plant requires.

The range of Syntron models includes vibrators to keep materials flowing, feeders to ensure steady delivery, and packers for filling or compacting.

The vibrator unit comprises an electro-magnet with variable amplitude control. The length of 'stroke' can be made long for light materials, or short for dense granular products. Units are supplied complete with suitable controllers for connecting direct to single-phase 50-cycle supply.

S.24A

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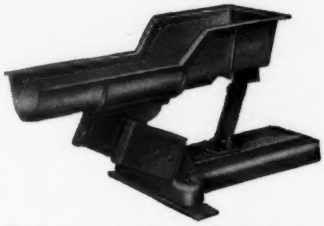
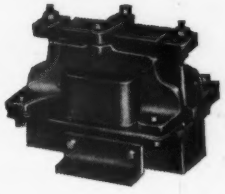
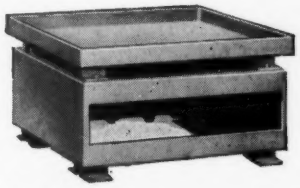


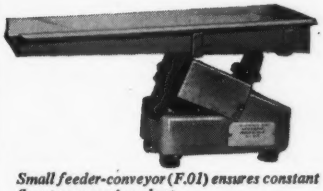
F.2 feeder-conveyor for controlled feeding to screens, pulverisers, weighing machines etc.



Medium duty vibrator, V.55, keeps materials running freely from bins, hoppers, chutes etc. Other sizes available.



Syntron Packers for economical filling of drums, cartons etc.; for mould and form shaking; for paper jogging.



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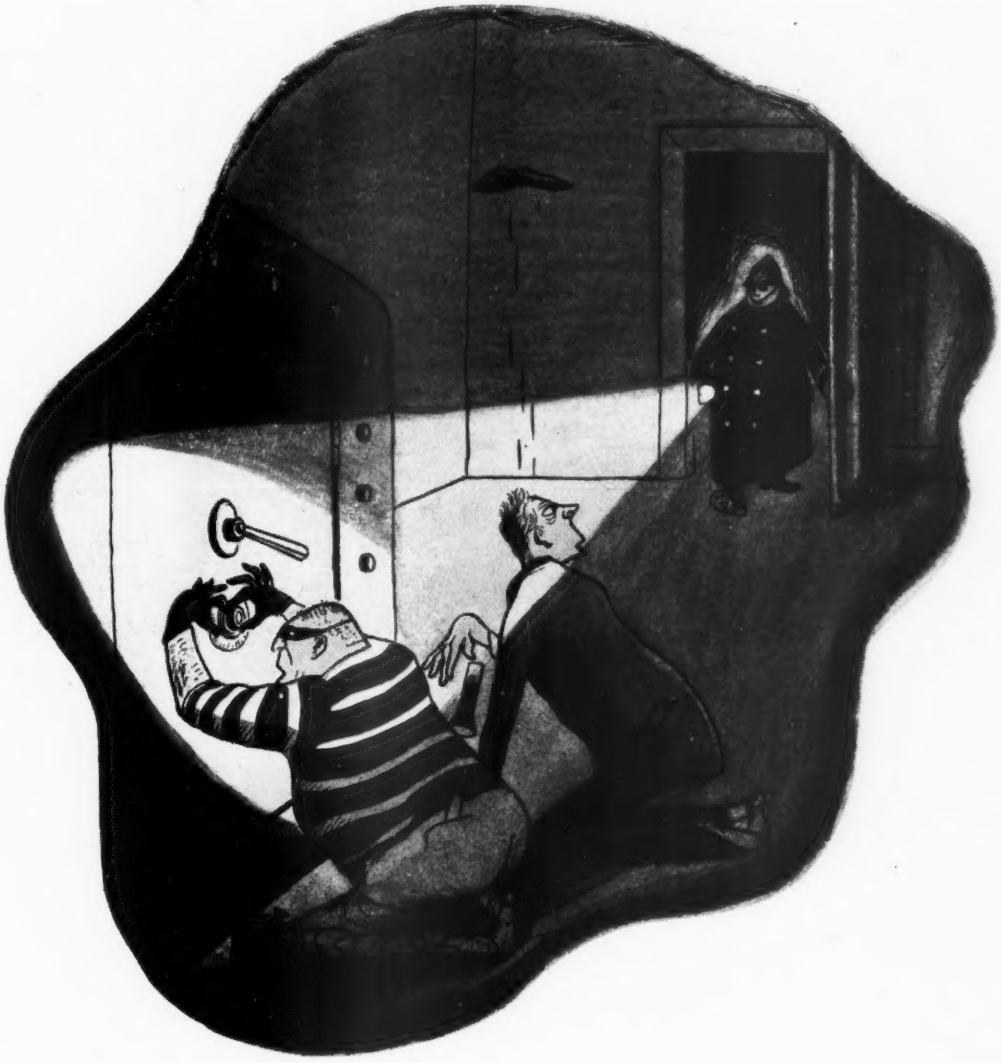

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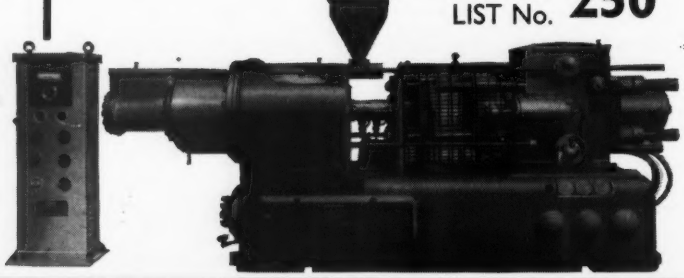

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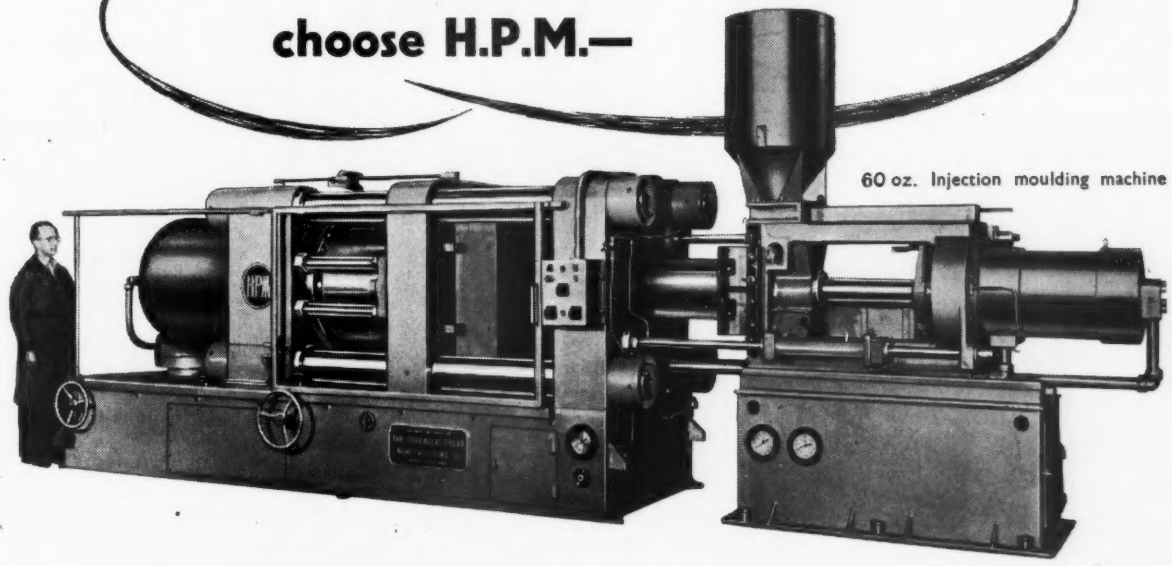

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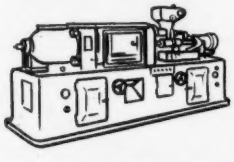

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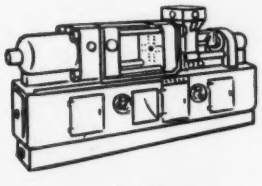

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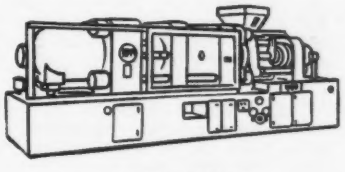

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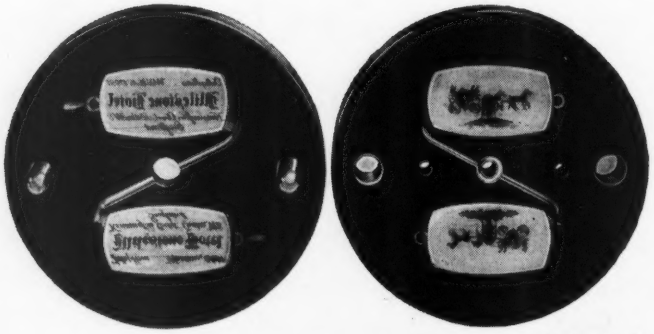

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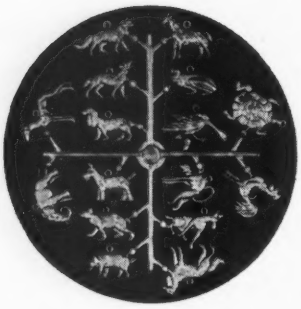

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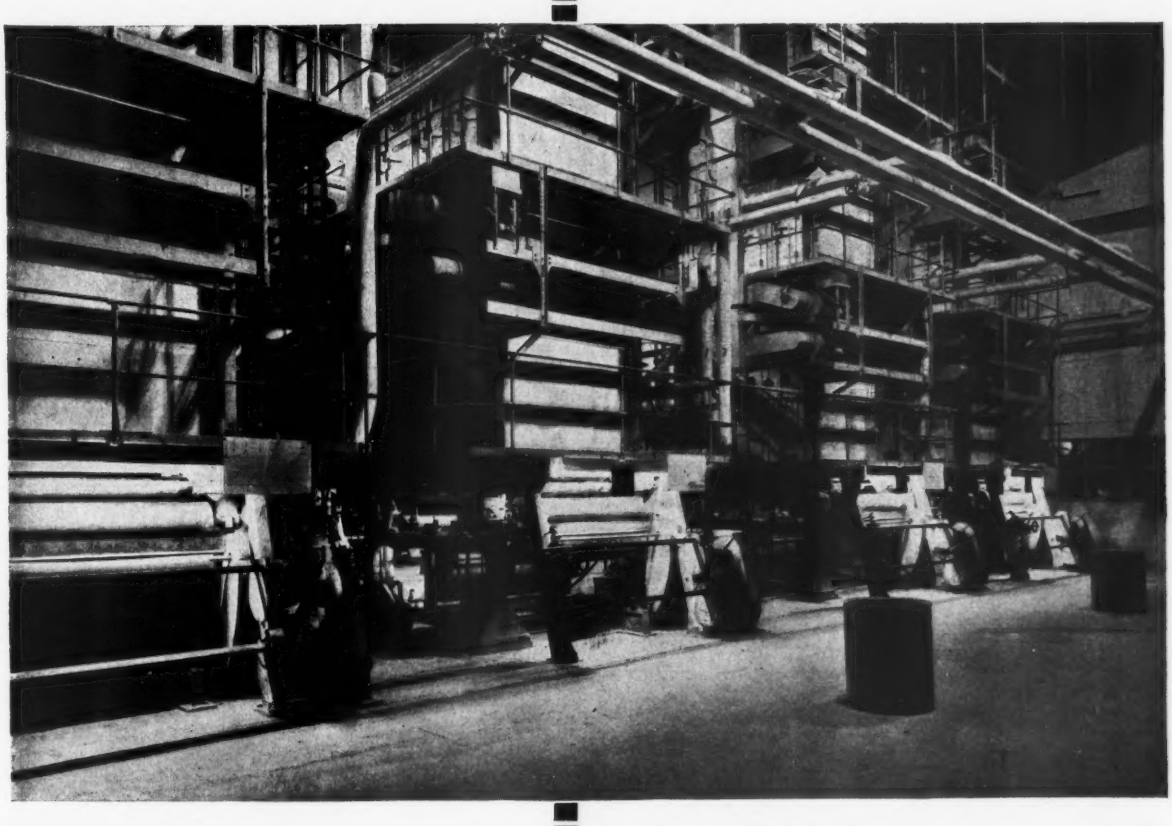

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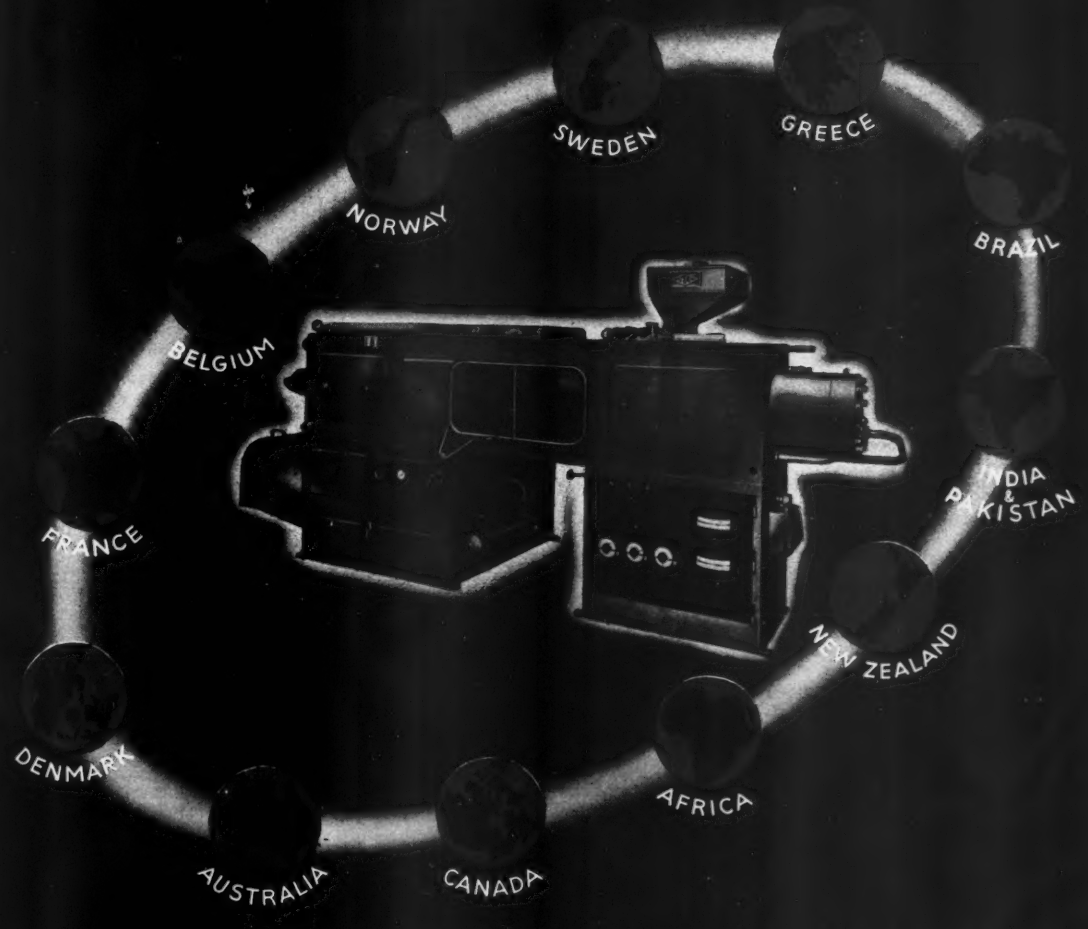

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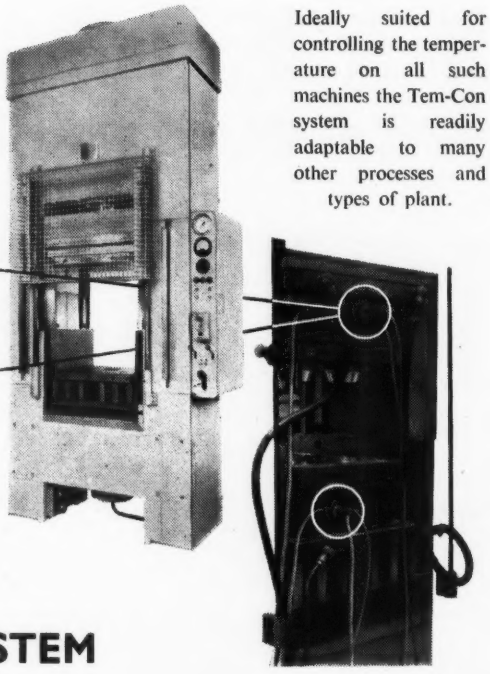

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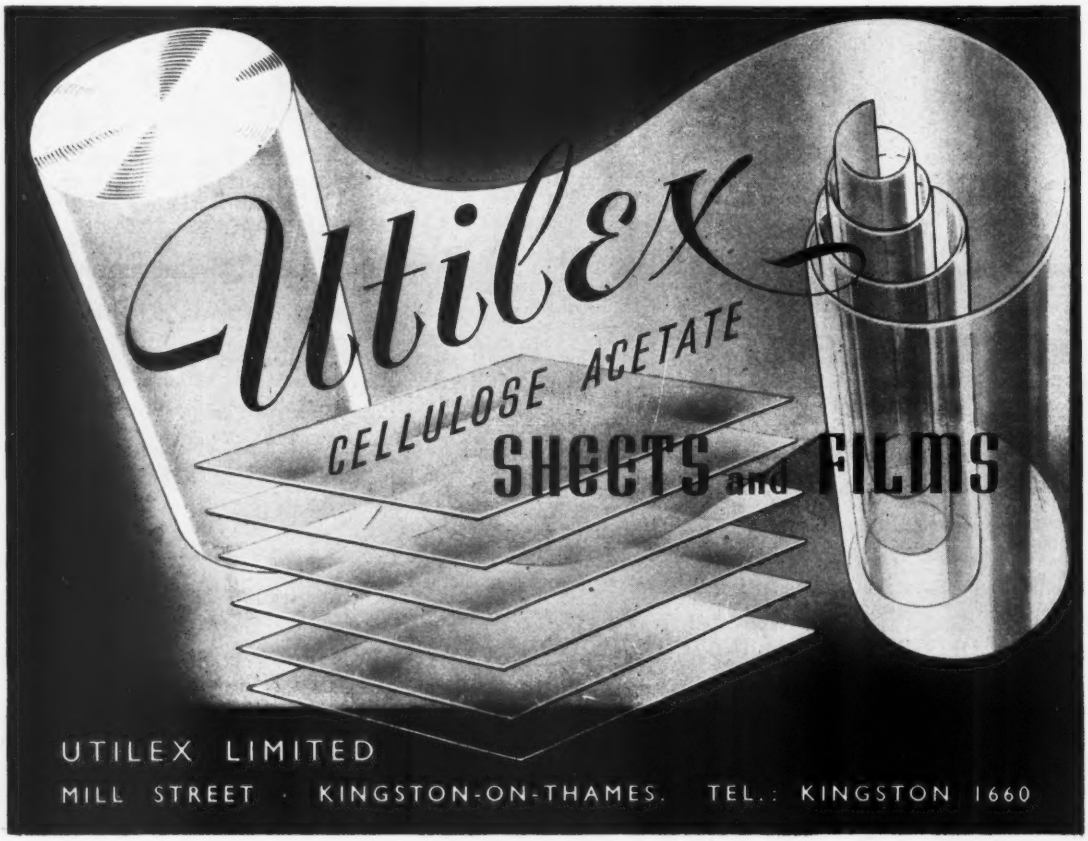

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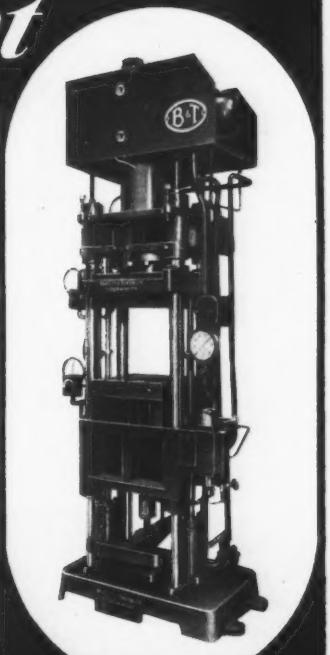

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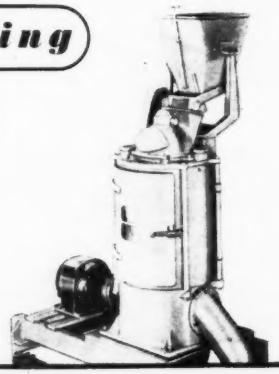

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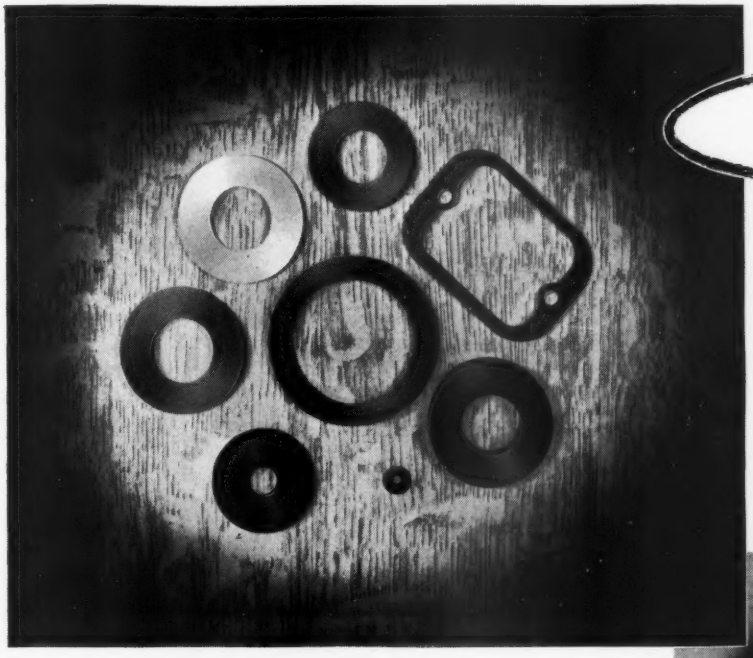

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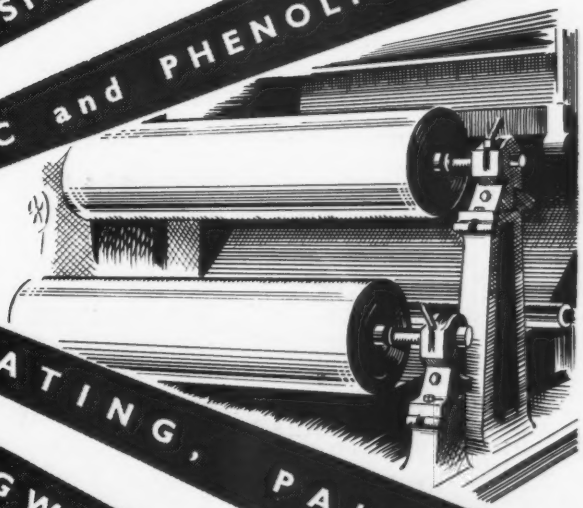

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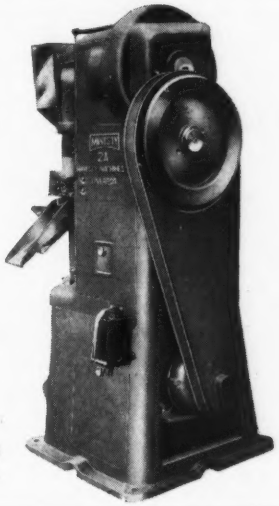

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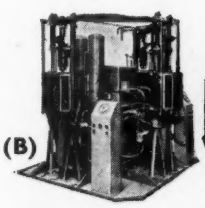
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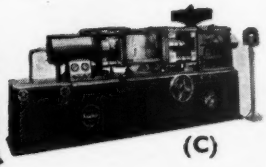
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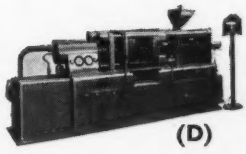
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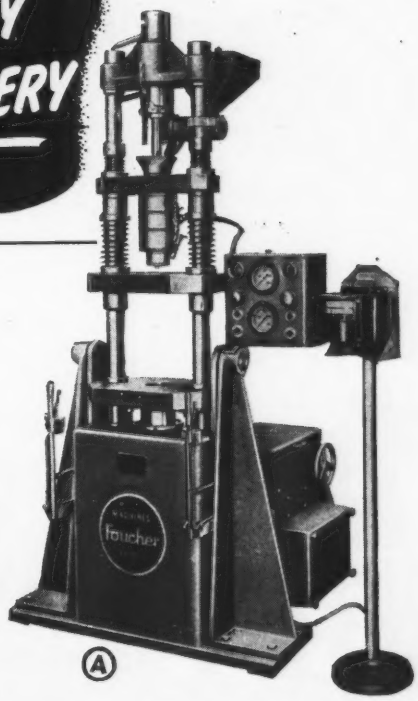

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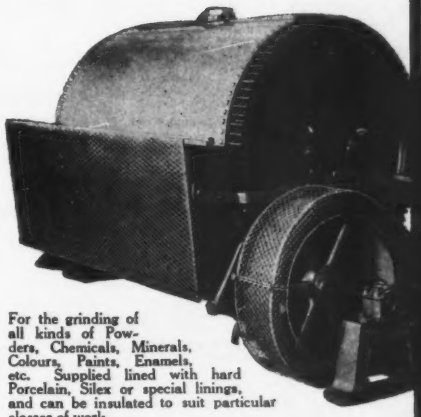

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AGENCIES

PLASTIC FASTENER PATENT for sale or licence. Many uses, garments, overalls. Mr. Walker, Tech-Aid, 31 Hanley Road, Hanley 25784. 175-x647

BOOKS AND PUBLICATIONS—WANTED

WORTH-WHILE OFFER made for the following back numbers. Plastics Institute Transactions—January 1933, January 1934, January 1935. Would some kind person please contact Box P721, care of "Plastics." 175-30

BUSINESSES, PREMISES, OFFICES, ETC.

FOR SALE, compression moulding business, including two 50-ton down-stroke presses and one 100-ton press, small toolroom, finishing plant, etc. Business include patented article with assured annual turnover. Good opportunity for moulder to commence business in Australia. Novex Pty., Ltd., Hobart, Tasmania. Cable address, "Novex." 175-2774

FOR SALE: Company, authorized capital £7,000, issued £6,000, income tax losses to December 31, 1950, £2,394. Main objects, plastic products for industrial dental, medical and optical trades. Write Box P752, care of "Plastics." 175-27

FINANCIAL AND PARTNERSHIP

CAPITAL AVAILABLE for investment in progressive plastics firm. Working directorship or partnership required. London area. All inquiries treated in strictest confidence. Box P7538, care of "Plastics." 175-47

MACHINERY, TOOLS AND PLANT

ALTERNATORS. Diesel sets, electric motors, switch gear, transmission equipment, fluorescent lighting and industrial fittings ex stock. Keen prices. Contact G. L. Murphy, Ltd., Menston, near Leeds. zzz-210

PLASTIC PLANT SPECIALISTS.
MODERN MOULDING PRESSES.
MIXING MILLS.
EXTRUDERS.
HYDRAULIC PLANT.
Always in stock. Send us your inquiries.
Whatever your NEED ask
REED BROTHERS (ENGINEERING), LTD.,
REPLANT WORKS,
CUBA STREET,
MILLWALL, LONDON, E.14. zzz-269

JACKETED PANS. Eight copper melting pans, 18 ins. diameter by 12 ins. deep with covers, mounted in steel frames with valves, steam traps, etc., as new, £25 each. Thompson and Son (Millwall), Ltd., Cuba Street, London, E.14. zzz-311

NEW ELECTRIC 4-CYLINDER HYDRAULIC PUMPS, 4 gallons per minute at 1 ton per square inch, 3-phase 400-440 volts, £80. Also ditto ½-ton pressure, £65. John Steel, Castlefields, Bingley. 178-2724

6-OZ. T.M.A. FOR SALE, £600, ex works. Seen working by appointment. Universal Plastics, Ltd., Brook Road, N.22. 175-x80

PLANT FOR SALE. Below.
Four sets of 2-12-ton down-stroke presses, platen area approximately 8 ins. by 8 ins. Below.
Two Frazer Mono-radio hydraulic pumps, complete with motors, for use with above. Below.
One 25-ton up-stroke hydraulic press with side-column return rams, platens area 18 ins. by 18 ins., complete with thermostatically controlled heated platens. Below.
One Westminster ¼-oz. injection-moulding machine, hand operated. Below.
Four 10-ton up-stroke hydraulic laboratory presses. Below.
One Mason Seeley marking embossing and moulding machine, complete with electrically heated platens. Below.
One Jackson electrical oven. Below.
One Sigmund water pump, complete with motor. Below.
One Pacera bench drill, complete with motor. Below.
One jig-saw machine, bench type, complete with motor. Below.
One 7½ h.p. Brook motor, complete with capacitor starter. Below.
One 2 h.p. Mather and Platt motor. Below.
Six ¼ h.p. motors, assorted makes. Box P7526, care of "Plastics." 175-8

ONE NEEN VALLEY 2-OZ. HYDRAULIC INJECTION-MOULDING MACHINE (self-contained), motorized, 400/3/50. Box P7518, care of "Plastics." 175-12

B.C.S.
STORAGE TANKS.
One enclosed storage tank, welded construction, 14 ft. 6 in. long, 12 ft. 10 in. wide, 6 ft. high, approx. capacity 7,000 galls.
One dished end tank, riveted construction, 23 ft. long, 3 ft. 6 in. dia., approx. capacity 1,400 galls.
B.C.S. (ENGINEERS AND CONTRACTORS), LTD.,
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CARDIFF.
Phone 8512-3-4. 175-43

ONE SHAW HAND-OPERATED PLASTIC MOULDING MACHINE, 3-oz. capacity, five years' old, but used only once, perfect condition. Offers. Box P7511, care of "Plastics." 175-18

FOR SALE, one Raydyne welder, type W3B. Write, Box P754, care of "Plastics." 175-25

Machinery, Tools and Plant (contd.)

B.C.S.
LANCASHIRE BOILERS.
(1) 30 ft. by 9 ft. Danks twin flue Lancashire boiler, 175 lb. p.s.i. working pressure, complete with fittings and mountings and grates for hand firing.
(2) 30 ft. by 9 ft. Danks ditto, 160 lb. p.s.i. working pressure.
(3) 30 ft. by 8 ft. 6 in. Danks ditto, 160 lb. p.s.i. working pressure.
(4) 30 ft. by 8 ft. 6 in. Yates and Thom, ditto, 160 lb. working pressure, fitted with Bennis stokers, complete with feed pump, chimney, etc. (2 available).
(5) 30 ft. by 8 ft. Marshall ditto, 160 lb. working pressure, complete with fittings and mountings and grates for hand firing. (2 available.)
(6) 30 ft. by 80 ft. Inman ditto, 160 lb. working pressure.
Full particulars and copy of Insurance Reports from:—
B.C.S. (ENGINEERS AND CONTRACTORS), LTD.,
3 CASTLE STREET,
CARDIFF.
Phone 8512-3-4. 175-44

FOR SALE, 2 by 1¼-oz. injection-moulding machines, and three Francis Shaw machines, all in full production. Can be seen by appointment. Phone, Gerrard 3688-9. 175-34

COMB-MAKING PLANT, comprising 1½-oz. Edgwick injection-moulding machine, complete, and three comb moulds, pocket comb, dressing comb and side comb. Selling cheap. Box P7536, care of "Plastics." 175-x649

INJECTION MOULDING MACHINES for sale: One N.V.10 hand-operated 10 grammes, two N.V.30 air-operated 30 grammes, gas heated, complete with Broom and Wade compressor, with motor starter, and main balancing tanks, complete with four master moulds, £450 the lot. Courtenay, Ltd., 138 Stratford Road, Birmingham, 11. 176-x9827

HELE SHAW HIGH-SPEED ROTARY HYDRAULIC PUMP, having six double-acting plungers, 2¼-in. diameter by 1⅞-in. stroke, delivering approximately 50 gallons p.m. at 700-1,000 lb. per sq. in. Below.
35 h.p. Brooks slip-ring motor, 415 volts, three-phase, 50-cycles, 1,000 r.p.m., together with oil-immersed starter. Below.
Hydraulic Intensifier. Low pressure ram 22 ins. diameter. High pressure ram 9½ ins. diameter, stroke approximately 5 ft.. Ratio 5½/1 to intensify from 800 lb. to 2 tons per sq. in. Below.
Small two-throw vertical hydraulic pump, by John Shaw. Working pressure 2 tons per sq. in. Automatic change from low to high pressure. Below.
Small two-plunger horizontal hydraulic pump. Two tons per square inch working pressure. Mounted on a tank. Below.
Will sell separately. Write to Box P7520, care of "Plastics." 176-2809

A NUMBER of injection and compression moulding tools for sale. The above can be viewed by arrangement. Mr. A. Rushton, Combined Optical Industries, Ltd., Piasta Works, Bath Road, Slough, Bucks. Slough 21292. 175-x9652

MACHINERY, TOOLS AND PLANT WANTED

THREE 100-ton Plastic down-stroke moulding presses—preferably Daniels with ejectors and electrically heated platen. Self-contained pumping units preferred. Write Box 729, care of Walter Judd, Ltd., 47 Gresham Street, E.C.2. 175-2726

INJECTION-MOULDING MACHINE required, second-hand, Hupfield 1-2 oz., or T.M.A. 3 oz. Must be latest model, in perfect running condition. Reply Box P7514, care of "Plastics." 175-15

100- OR 150-TON DOWNSTROKE HYDRAULIC PRESS for compression moulding, fully self-contained with rotary pumps, etc. Daniels or Bradley and Turton for preference. Box P7522, care of "Plastics." 175-9

2-OZ. OR 4-OZ. INJECTION MACHINES required. Must be in good condition. Reply, giving full details and price to Lacrinoid Products, Ltd., Gidea Park, Essex. 175-38

PATENTS

THE PROPRIETOR(S) of Patent No. 594,835 for "Method for the Preparation of Wood Pulp" desire to secure commercial exploitation by licence in the United Kingdom. Replies to Haseltine Lake and Co., 28 Southampton Buildings, Chancery Lane, London, W.C.2. 175-32

PRODUCTION CAPACITY AVAILABLE AND WANTED

COMPRESSION AND INJECTION MOULDING, capacity available, reasonable delivery, competitive prices. Box P644, care of "Plastics." 175-2618

MOULDING CAPACITY available up to 3 ozs. injection and 50 tons compression. Small electrical medical equipment mouldings our speciality. Solsway Plastic Laboratories, Ltd., Lancaster Road, High Wycombe. Phone, High Wycombe 2136. 175-2613

SHORT RUNS A SPECIALITY. Long runs a pleasure. Low mould costs and overheads on our Westminster injection machines. Westminster Plastics, 367 High Street North, Manor Park, London, E.12. Grangewood 3777. 175-2611

INJECTION MOULDING IN POLYSTYRENE AND ACETATE, ETC. Capacity available on modern mass production plant up to 8 oz. Can use your moulds or produce moulds in our first-class tool-room. We have extensive and long experience in production of industrial, fancy goods and toys. Plasticast Developments, Ltd., Princess Street Peterborough. 183-2679

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11 WHITWORTH STREET,
MANCHESTER, 1.
Central 0272, 1725, 1000. zzz-316

INJECTION MOULDING by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 184-2728

DINES PRODUCTS, Stanley Road, Grays, Essex, for injection moulding. 178-2729

CUTTING SERVICE available for all thin plastic films. We cut from rolls into sheets or small pieces dead accurately. Cellulose acetate, Cellophane, Pliofilm, etc., thinnest grades also handled. Apply, Morol, Ltd., 21 Woodthorpe Road, Ashford, Middlesex. 175-2725

Production Capacity Available and Wanted (contd.)

KINGSTON PLASTICS, LTD., Unity Works, Union Street, Kingston-on-Thames. Manufacturers of virgin and second-grade cellulose acetate moulding powders, matched to customer's own requirements for colour and flow. Customer's own waste also reprocessed to specified requirements. Sorting and grinding, incorporating magnetic separation of metallic particles, of all thermoplastics undertaken. Phone, Kingston 8405. zzz-315

FAIRMAN PRECISION TOOLS AND PRODUCTS, LTD., of Horley, Surrey, have capacity for the manufacture of Bakelite and plastic moulds, die-casting, dies, press tools and special-purpose machines. Also all classes production machining. Phone, Horley 909. 184-2735

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ELECTROPLATED, plastics, china, etc. Technical specialist wishes to contact firm interested in developing this market. Advertiser has 25 years' wide experience in general metal and other finishes. Box P7528, care of "Plastics." 175-x239

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RAW MATERIAL AVAILABLE AND WANTED

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Michael S. Stevens, Keswick Works, Putney, S.W.15. Vandyke 3345. 184-2727

WASHED ACETATE X-RAY SHEET, sizes 8½ ins. by 6½ ins. to 15 ins. by 12 ins. and parcels mixed sizes; Celastoid sheet, 27 ins. by 24 ins. by .015 in., in pink, green, blue; mixed acetate and nitrate rolls, 5 ins. by approximately 24 ft., with light imprint similar in sheet, approximately 24 ins. by 20 ins. by .003 in. Lists and samples from
Lloyd's, 2 High Street, Christchurch, Hants. Phone, Christchurch 504. zzz-302

POLYTHENE scrap and virgin material in large quantities urgently wanted. Best prices paid. Please offer with samples to Herbert Connor, 120, Beaufort Park, Falloden Way, London, N.W.11. 175-3

ACETATE SHEET, 20, 30 and 40 thou. clear for disposal; roll Clarifoil, 39 ins. wide, 3 thou., 140 lb., new. Wanted, Perspex ⅛-in. 461 and 491 to complete work. Bly, 370 Upper Street, London, N.1. Can 3425. 175-2594

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CLEAR CELLULOSE ACETATE TUBING for all pen refills. Lactoid and erinoid rods in mottled, silks and plain colours, ebonite rods, tubes and sheet. Prompt deliveries assured from A. E. Goodeve, Ltd., 188a Seven Sisters Road, London, N.7. Archway 3654. 175-2261

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4½ TONS BUFF VIRGIN DIAKON MOULDING POWDER for sale. Apply, Box P6725, care of "Plastics." zzz-317

REPROCESSED POLYSTYRENE, first-class quality in many colours matching to any special requirements. Please send your inquiry to Herbert Connor, 120 Beaufort Park, Falloden Way, London, N.W.11. 175-4

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ERLANOS, LTD., 93 Aldersgate Street, E.C.1. (Monarch 4686, require Perspex and cellulose off-cut and scrap, clear and coloured, highest prices paid. 179-2769

GOING CHEAP, Aladdinite luminous sheets, glows in dark. Opticrafts, Alpha Road, Surbiton, Surrey. 175-2770

P.V.C. WANTED, virgin compound and clean scrap. We collect and pay cash. Box P741, care of "Plastics." zzz-320

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2¼ TONS REWORKED BLACK ACETATE, 15 cwt virgin Erinoid baby pink acetate. All in sealed bags. Offers to Box P742, care of "Plastics." zzz-321

WANTED, polythene scrap. Write to Box P7416, care of "Plastics." zzz-322

PERSPEX SHEETS/SCRAP, clear and coloured, large stock, wide assortment at competitive prices. Apply Box P7534, care of "Plastics." 186-2813

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CUEX, LTD., can offer all at prices well below current list:—
Polystyrene.
Cellulose Acetate.
Polyethylene.
P.V.C.
Polyvinyl Butyral.
Perspex and Diakon.
Send now for details.
Cuex, Ltd., 270 Corporation Street, Birmingham Central 5474. 175-29

CELLULOSE ACETATE SHEET, several colours available, 8s. per lb. Write for particulars to Box P751, care of "Plastics." 175-28

VERY GOOD PRICES paid for clean P.V.C. handbag sheeting offcuts. Box P759, care of "Plastics." 175-24

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Raw Material Available and Wanted (contd.)

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REPROCESSED P.V.C. COMPOUND, red/brown, reinforced with fibrous filler, especially suitable flooring, etc., 1s. per lb.; larger quantity. Box P757, care of "Plastics." 175-22

HIGH PRICES PAID for plasticizers surplus to manufacturer's requirements. Box P756, care of "Plastics" 175-21

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BLACK CELLULOID SHEETS, approximately 4½ tons for sale, 50 ins. by 20 ins. by .130-in. thick, polished both sides. Box P7411, care of "Plsatics." 175-31

SURPLUS TO REQUIREMENTS, 20-25 tons B.A.R., 500 lb. Di Allyl Phthalate, 708 lb. Di Iso Butyl Ketone, 520 lb. Furfural, 5,000 lb. Glycerol Mono Cresyl Di Acetate, 820 lb. Isophorone, 450 lb. Tetrahydrofurane, 300 lb. Tetrahydrofurfural, 600 lb. Sodium Perborate. Box P7513, care of "Plastics." 175-16

ALKATHENE POLYSTYRENE AND ACETATE MATERIAL, available for use in our machines using your moulds up to 3 oz. Inquiries for any injection moulding to Severn Plastics, Stonehouse, Glos. Phone, Stonehouse 6453. 175-x380

EX MANCHESTER: 15 cwt. British tricresyl phosphate. Ex London: 1 ton titanium anatase, 98-100 per cent.; two drums dibutyl phthalate 2 tons titanium in dibutyl phthalate. Box P7532, care of "Plastics." 175-x9861

CELLULOID SHEETS, various colours and thicknesses, far below works price, as surplus for disposal. Box P7524, care of "Plastics." 175-2

PURE NYLON WASTE, regular quantities available. Rudston Products, Ltd., 9a Margaret Street, London, W.1. 175-x538

BLANKS. Perspex and other plastic materials can be supplied by us at highly competitive prices. Please write for quotation to Box P755, care of "Plastics." 177-2811

CELLULOSE ACETATE.

ADVERTISER OFFERS APPROXIMATELY 4 TONS OF GREY PEARL POWDER OF PLEASING APPEARANCE.

SAMPLE MOULDING ON APPLICATION.

APPLY PURCHASING MANAGER,
KENT MOULDINGS,
FOOTSCRAY, SIDCUP, KENT. 175-45

WANTED, surplus or redundant merchandise, clearance stocks of any description or discontinued lines. Cash immediately—no delay. Our representative will be pleased to call or, alternatively, please send samples with particulars, quantity and price. Lawrence Edwards and Co., 6-7 Wellington Close, Ledbury Road, London, W.11. Phone, Bayswater 4020. 175-42

FOR SALE. Butyrate and acetate tubing (new):—
80,000 ft. red Butyrate in 10-ft. lengths.
10,000 ft. red acetate in 10-ft. lengths. 1,700 lb. black acetate in 10-ft. lengths.
Diameters, O.D. .225 I.D. .098.
337 lbs. of clear acetate capillaries.
John Castle and Co., Ltd., 5 Hurley Road, Kennington, London, S.E.11. Reliance 4274. 176-2807

ADVERTISERS ARE WILLING TO PURCHASE SMALL OR LARGE TONNAGES of off cuts and scrap, provided these are urea-formaldehyde or casein unadulterated with other types of plastic, and not mixed with metal parts such as eyelets or screws or other foreign matter. White, brown or black parts are preferred, although brightly coloured parts are not a disadvantage provided they are in the minority. If terms suitable, regular and continuous business is envisaged. Apply to C. Vernon and Sons (Liverpool), Ltd., Advertising Agents, 10 Rumford Place, Liverpool, 3. 175-35

P.V.C. INJECTION POWDER 55 lb. in colours, yellow, blue and green. Below.
Phenol. Maroon compresaion powder, 700 lb., black compression powder, 540 lb. Below.
Co-pol. Red, maroon, 90 lb. Offers to: Box P7525, care of "Plastics." 175-7

SITUATIONS VACANT

PLASTICS. Complete, inexpensive tuition at low inclusive fees. For free details write to The Principal, The Rapid Results College of Engineering Technology, Dept. E.152, Tuition House, London, S.W.19 (or call at 235 Grand Buildings, Trafalgar Square, W.C.2). Whitehall 8877. zzz-300

A LEADING FIRM OF P.V.C. (PLASTIC) SHEETING MANUFACTURERS require two sales representatives for the London and Midlands areas to call on the handbag and fancy leather goods trades. These are permanent and progressive positions with good prospects for two keen and reliable men. Experience and connections essential. Applications will be treated in strict confidence. Particulars in writing, giving age, experience and salary required to Sales Manager, Commercial Plastics, Ltd., 1-9 Hills Place, Oxford Street, London, W.1. 175-33

WORKING MANAGER with full knowledge of plastic injection moulding and mould setting, able to plan production, control progress and staff, excellent opportunity for man who will get things done, small factory at Acton. Write age, experience, salary, to Transradio, Ltd., 138a Cromwell Road, London, S.W.7. zzz-324

TECHNICAL SALES REPRESENTATIVE for London and Home Counties required by large manufacturer of industrial phenolic laminates. Candidates must have established contacts in electrical industry and some knowledge of general electrical engineering, salary commensurate with experience. Write, giving full details of past experience and salary required to Box P753, care of "Plastics." 175-26

EXPERIENCED AND CAPABLE PLASTICS MANAGER (injection mouldings) required by company subcontracting in large way. Duties will include supervision from development states, placing of moulds, production and progressing. Exceptional opportunity for man with necessary qualifications and good personality. Apply, giving full details of salary required to Box P7510, care of "Plastics." 175-19

RESINOID AND MICA PRODUCTS, LTD., require three technical representatives for London and the South, the Midlands, and the North of England, to contact users of industrial plastics. Previous experience or a suitable engineering background desirable. Remuneration by salary and commission. Apply, in strict confidence, to the Senior Sales Engineer, Resinoid and Mica Products, Ltd., 28 Queen Anne's Gate, London, S.W.1. 175-41

MANAGER FOR SMALL PLASTICS PLANT, HIGH WYCOMBE. Must be experienced in plant maintenance, injection and compression moulding, with knowledge of material buying and mould making. Good opportunity for skilled, resourceful man with growing company. Preference for man over 40, but not essential. Write, stating age, experience, salary required, to Box M.3223, Haddons, Salisbury Square, London, E.C.4. 175-36

Situations Vacant (contd.)

PRODUCTION CONTROLLER in charge of purchasing required. Only applicants with practical experience in the plastics industry will be considered. Apply in writing, giving full details of experience and salary required, to Lacrinoid Products, Ltd., Gidea Park, Essex. 175-37

UNIVERSAL MILLERS required, fully experienced in die sinking, excellent opportunity, permanent posts and high rate for right men. Box P7515, care of "Plastics." 176-2810

FOREMAN required to take charge of Plastic Moulding Shop, thermo-setting and thermoplastic. Must have full engineering knowledge of presses and press tools both from the production and maintenance aspects. Only first-class men, resourceful and accustomed to working on their own initiative should apply for this position, which offers good prospects. Box P7512, care of "Plastics." 175-17

TOOL ESTIMATOR (free lance) required having wide experience in manufacture of compression and injection moulds, also press tools, by firm in South-east London. Box P7516, care of "Plastics." 175-14

TOOL DESIGNER, with considerable experience of injection moulding work, required by large company in North Midlands. High salary and excellent prospects for right man. Full details to Box P7517, care of "Plastics." 175-13

ASSISTANT CHIEF DESIGNER wanted by large moulding firm in the North of England—compression, transfer and injection. Capable of super-vising tool design and tool estimating. Good salary and prospects for the right man. Please reply, stating age, experience and salary required, to Box P7519, care of "Plastics." 175-11

EXTRUSION SHOP FOREMAN wanted for wire and cable production. Only absolutely qualified man acceptable with sufficient technical knowledge, experience and drive to fully guarantee smooth production flow. State age, qualifications, jobs held, salary. Box P7521, care of "Plastics." 175-10

SITUATIONS WANTED

INJECTION MOULDING FOREMAN desires progressive situation; willing to study for advancement; technical knowledge of compression moulding. All offers considered and answered. Resident in London. Box P7530, care of "Plastics." 175-x9409

ASSISTANT SALES MANAGER, young man seeks responsible position requiring initiative, energy and drive, well used to interviewing clients, sound technical knowledge of extrusion, dip and injection moulding, own car. Box P7537, care of "Plastics." 175-46

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Trade Mark Protection Society,
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STAFF TIME CHECKING AND JOB COSTING TIME RECORDERS, all makes, for quick cash sale, exceptional condition. Write, Box 756, Smiths, 100 Fleet Street, E.C.4. 175-39

PAPER SACKS, second-hand, good condition, required by large users. Box P7529, care of "Plastics." 176-x181

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